Science and Invention

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NESTLER RUBBER FUSING PROCESS

EASILY LEARNED

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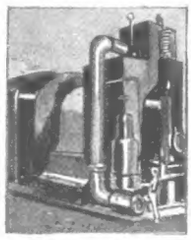

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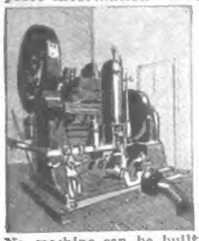

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Vol. XIV
Whole No.
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Are your tonsils and sinuses healthy? Methods now used for diagnosing them when diseased will be illustrated and described.

Home Mechanics!

Full details will appear in the next issue for building a home telephone table and stool.

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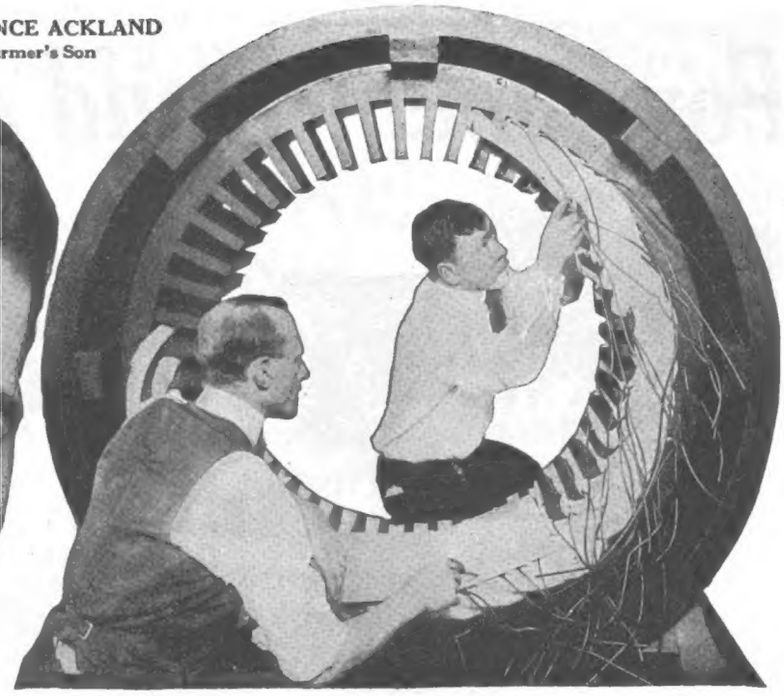

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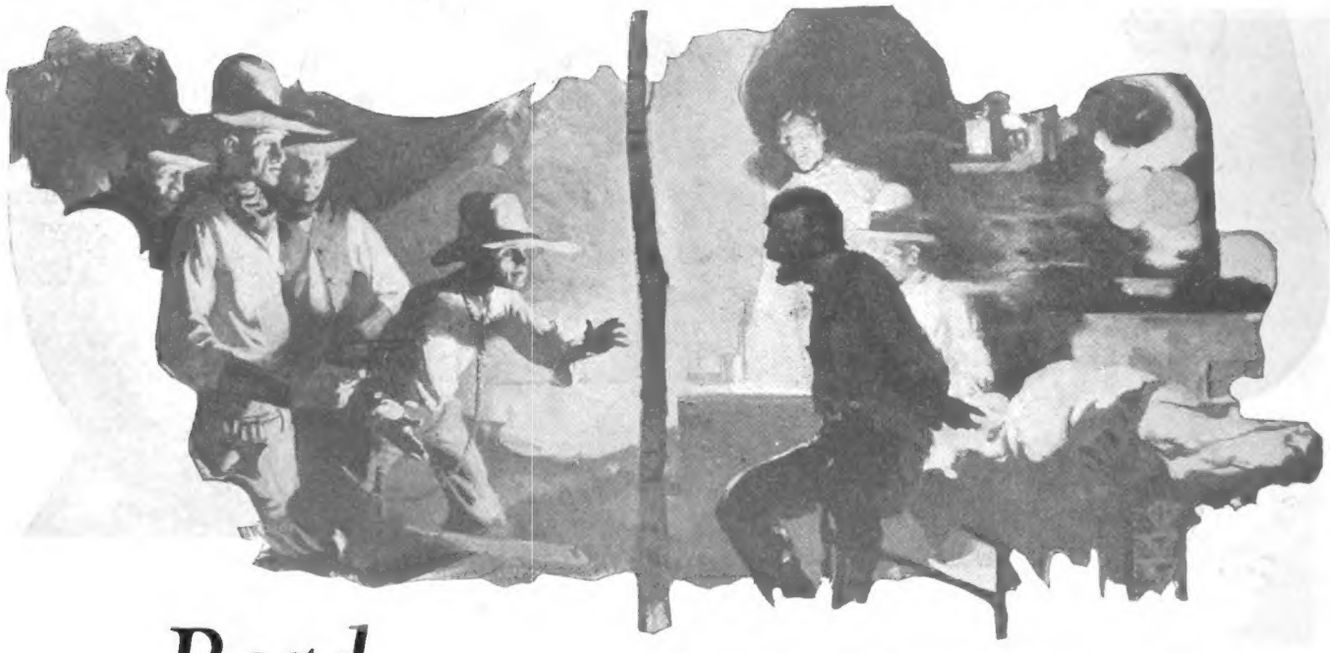

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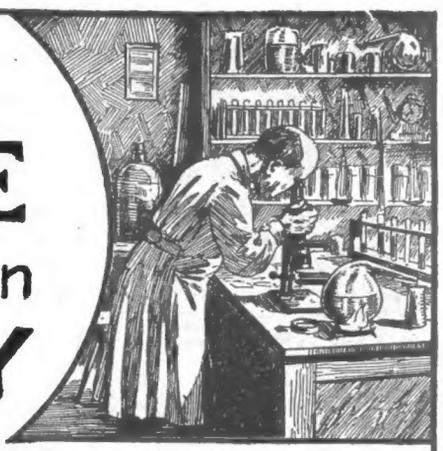

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T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.
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Volume XIV
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Science and Invention

March, 1927
No. 11

HUGO GERNSBACK, *Editor-in-Chief*
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DR. T. O'CONOR SLOANE, Ph.D., *Associate Editor*
Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

SCIENCE LENGTHENS OUR LIVES

By HUGO GERNSBACK

AS little as twenty generations ago, the average span of life of mankind was about forty years. In those days one did not expect to live longer than forty years, and while there were exceptions, to be sure, the average life-time of the ancient Roman, the ancient Greek, and men of the Middle Ages, was forty years. The greatest progress toward the conservation of human life and the lengthening of the span thereof, was made during the past 100 years. Medicine, which even today is not an exact science, was much less so in comparatively modern times. Some of the crudest, and, to us the most childish, "remedies" were used, even as recently as fifty years ago, and if you see some of our present-day patent medicines you may well ask yourself whether we have gained much knowledge today.

The diseases, however, that put out most lives, such as, for instance, pestilence, cholera, syphilis, and many other extremely contagious diseases, have today been checked to a large extent by sanitation and by a better understanding of the diseases themselves. The microscope possibly has done more to bring about this result than has any other agency. It has enabled our bacteriologists to wage successful war against germ life in general, and it may be said that we are making some satisfactory progress. To be sure, all of the diseases above named, and many more equally disastrous ones, are still with us, but it may also be said that they are now more under control than ever before, and that no country-wide epidemic can gain great headway in these days, except, perhaps, in uncivilized countries or inaccessible districts.

During the comparatively short span of 100 years, thanks to science, human life has been increased from 40 to some 60-odd years. This is really a tremendous increase for such a short time, and the results are due entirely to science. We do not even realize today that millions of our ancestors died annually, of such comparatively simple things as direct infections due to cuts, diseased teeth, and other equally simple causes,—all of which are today not even considered, because we have been taught to take care of such things in their inception, and think no more of them than of brushing off a fly. To be sure, we do not wear ourselves out as much as we did generations ago. We conserve our energies due to better transportation facilities, labor saving devices, etc., and thus we do not have to labor as hard as our grandfathers used to. All of this tends to lengthen our lives a great deal.

But it seems in Nature you can never expect to get anything for nothing. Thus, in lengthening the span of life, we have to pay certain penalties for this immediately, because of the softer and easier mode of living. The common cold and pneumonia, which are making inroads into our health, were practically unknown even a century ago. We know that they were in existence, but never reached such proportions as these afflictions do now. Some of our medical authorities also think that the curse of the present age, namely cancer, has been brought about directly by the softer living conditions and that new ways must be found to combat this terrifying disease, which so far has baffled science.

"Nerves" is another penalty which we have to pay, due to our present mode of living. General nervousness was not known a century ago, at least in the forms that we see today, and certainly it was not nearly as widespread as in these modern times.

Many other similar parallels could be drawn and the surprising thing is that we do not have more trouble than we actually do. If science were not on the high plane which it has reached already, we probably would run into a lot more mischief than we do.

The thought naturally arises, "How far can the average term of life be lengthened?" Some of our best authorities see no reason why a human being should not attain the age of several hundred years, not as some extraordinary feat, but considered as a fair average. There are, of course, people now living who are 125 years old, but these are, naturally, exceptions. Our medical scientists, however, assert that the goal of 200 years will be reached some day in the future. When we stop to think that the average life-time used to be 40 years and that we now consider the man of 50 years to be in the prime of his life; who knows but that fifty years hence a man in his prime will be 100 or 150 years of age.

It is well known that it takes a life-time to gain valuable experience. Men at the head of great industries frequently are over 60 years of age, and their advice is sought steadily because they have gained most valuable experience during all those years. It would seem, therefore, important to lengthen the span of life indefinitely, and, indeed, present indications are that it can and will be done.

Recent researches have shown conclusively that tissue and cells in the human body need not necessarily decay. Formerly it was thought that there was no way to ward off senility, and that cells were bound to break down, due to old age, which simply means wear and tear. This, however, in the light of modern science, is no longer countenanced. The more complete study of gland-science has convinced many physicists that the human cells can be rejuvenated or replaced continuously, and that such a thing as old age can be warded off for several hundreds of years, at least theoretically. Patients treated with transplanted glands or else with glandular extract, have shown this.

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Close-up view of the Dauvillier special vacuum tube used to reproduce image by virtue of cathode beam oscillated or controlled by electro-static fields.

Television by New French System

New Dauvillier System of Instantaneous Projection of Images Seems Promising

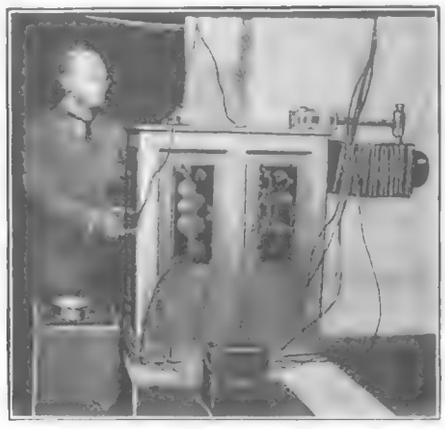
By LUCIEN FOURNIER

Receiving apparatus: A—fluorescent screen; B—calcium tube for producing a vacuum in the oscillograph; C—concentrating coil; D—cathodic oscillograph; E—plate batteries, 300 volts; F—potentiometer box.

MANY French scientists and those not of the lower ranks have attacked the problem of television, *i.e.*, seeing over a wire or via radio. Our readers are familiar with the Belin-Holweck system. We are going to speak now of the apparatus of Dauvillier, a young scientist, chief of the physical research laboratory for X-rays, founded by M. de Broglie. To explore the image M. Dauvillier utilizes two tuning forks kept in vibration by electricity, and producing induced currents. One of the tuning forks vibrates eight hundred times a second, and the other ten times a second. The induced currents are synchronic, which are conducted by wires to electrostatic fields in the cathodic oscillograph receiver which is a Braun tube. The author of these investigations proposes a direct solution of the problem of television. He tries to have two correspondents in telephonic communication see each other mutually, and this is why he calls the apparatus the telephot.

The image given by the objective strikes the mirror carried by one of the legs of the tuning fork of eight hundred vibrations per second. It is supported horizontally and the mirror is moved from right to left, and back again at the rate of eight hundred times per second. The image is transmitted in "horizontal vibrations" to a second mirror on the other tuning fork of 10-cycle periodicity. This is so arranged that the legs vibrate up and down. The image reflected by the two mirrors then has a rapid horizontal movement and a much slower vertical movement, as it is received on an opaque screen pierced by a hole. Each of the points which constitute it will pass through this hole and will pass in succession one after the other. Thus the image will be completely explored or traced.

As our diagram shows the point of light passing through the screen as it falls upon a photo-electric cell, familiar to all our readers, and the currents issuing from the photo-electric cell and produced by the ray of light are directed to the receiving station with the intermediation of an amplifier and two conducting wires. We said at the beginning that the electric tuning fork produced induced currents which became synchronized currents.



Exterior view of the Dauvillier television transmission apparatus and the inventor at its side.

These are produced in the coils shown in our diagram respectively of 800 cycles and of ten cycles, and after amplification reach the receiving station by three wires. The Dauvillier system includes then really five line wires.

The receiving station includes a Braun photo-electric tube which operates as follows. The current modulated by the luminous intensity varying for each point of the image passing through the hole in the diaphragm, is received by the grid-filament circuit of the Braun cathodic oscillograph.

It modifies the cathodic emission in exact correspondence with the variations of luminous intensity received by the transmitting vacuum tube. This is the first point to be noted. As regards the synchronic currents, they act upon the oscillograph by two electrostatic fields (see the diagram), which are simply due to two condensers placed at right angles to each other. These condensers perform the same functions as the coils of the Holweck oscillograph in the Belin aparatus.

By their action the synchronic currents act upon the cathodic beam causing it to vibrate exactly in the same conditions as due to the image to be transmitted after its reflection on the two mirrors of the electric tuning forks.

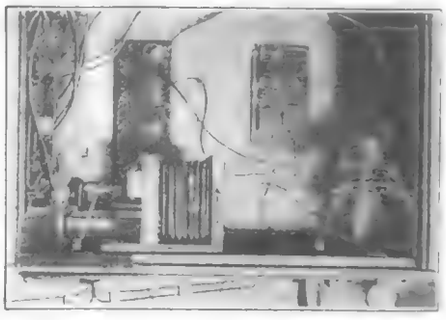
The cathodic beam now has to cover all of the fluorescent screen in its path determined by the Braun tube and then the image will appear. It will be seen that the Dauvillier system is very simple. There is no other mechanical part than the two electric tuning forks, which is a considerable advantage. The inventor has told us that he hopes very soon to solve the problem of television by using new special amplifying tubes.

TELEVISION IN DARK ROOM

Members of the British Royal Institution a year ago witnessed the first demonstration in history of television of human faces were recently allowed an opportunity to judge improvements in the process made in the course of twelve months by the inventor, J. L. Baird.

Mr. Baird proved a year ago that it was possible to combine sight and sound, but faces transmitted were under a light of such intense

(*Continued on page* 1066)



A—the two legs of the electric tuning fork of 10 cycles; B—mirror; C—screen; D—governing rheostat; E—the electric tuning fork of 800 cycles; F—photo-electric tube.

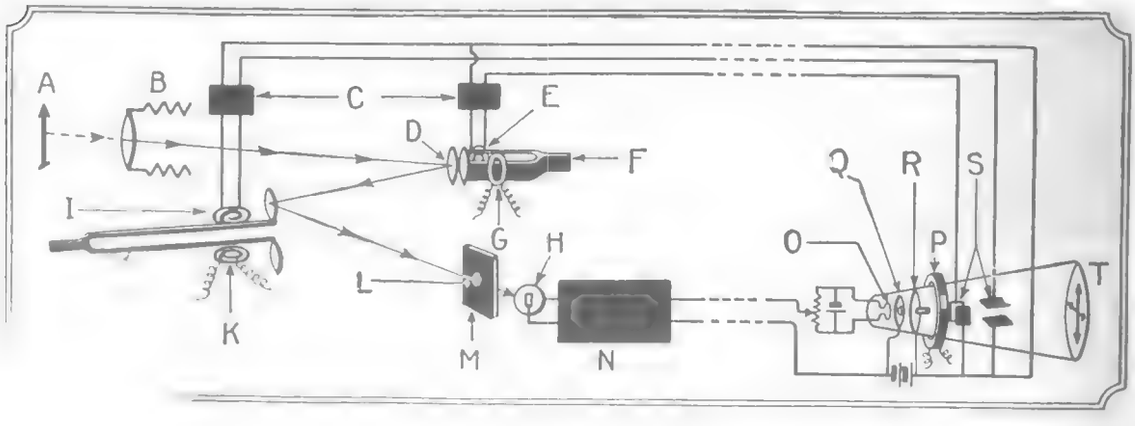
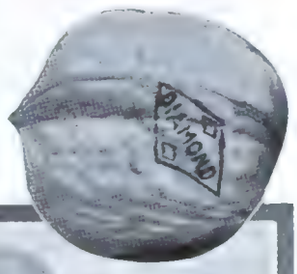
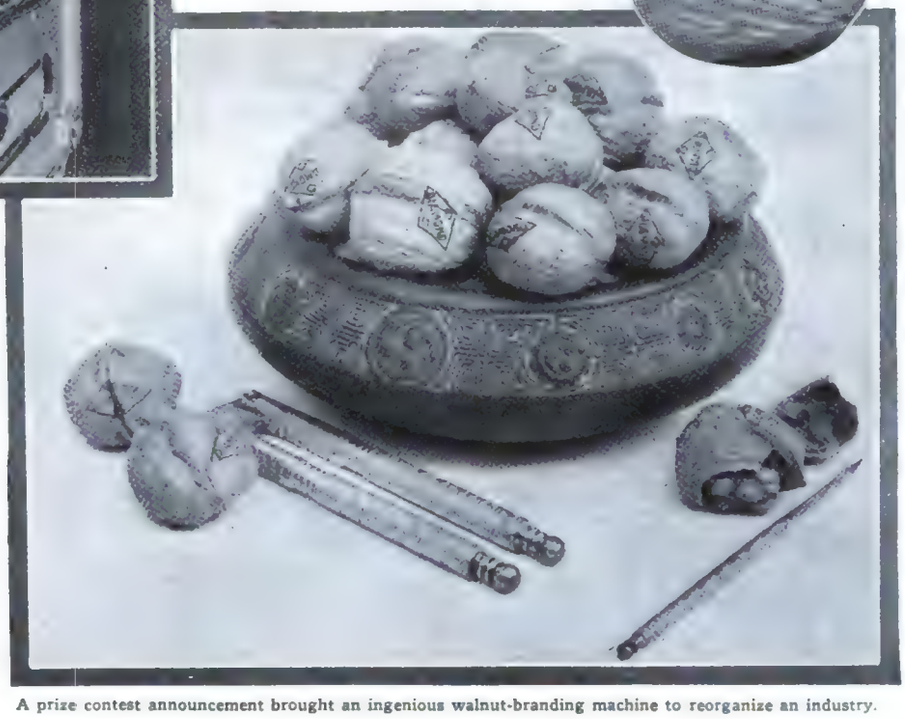


Diagram of the Dauvillier apparatus. A—object; B—objective; C—amplifier; D—mirror; E—coil generating synchronic currents; F—800 cycle tuning fork; G—exciting current; H—photo-electric cell; I—coil generating synchronous currents; J—10 cycle tuning fork; K—exciting current; L—hole determining the point of the image; M—optical screen; N—amplifier; O—filament; P—concentrating coil; Q—grid; R—plate; S—condensers producing electrostatic fields; T—fluorescent screen.

Trade-Marking Walnuts

SEVEN years ago the Walnut Growers Association advertised that they would pay $10,000 for a machine which would successfully and economically place their diamond brand on the uneven surface of walnut shells. Nine thousand replies and 150 working models were considered before this machine, developed by Rees and Wilkinson, two Los Angeles inventors, was finally accepted. About 125 of the branding machines have been installed in the association's 45 packing houses, through which pass 95% of the walnuts produced in the United States. This machine brands 2016 walnuts a minute, or a car-load of 30,000 pounds a day, at a cost of 1/20 of a cent per pound. The photos show the machine and the branded walnuts.—Delphia Phillips.





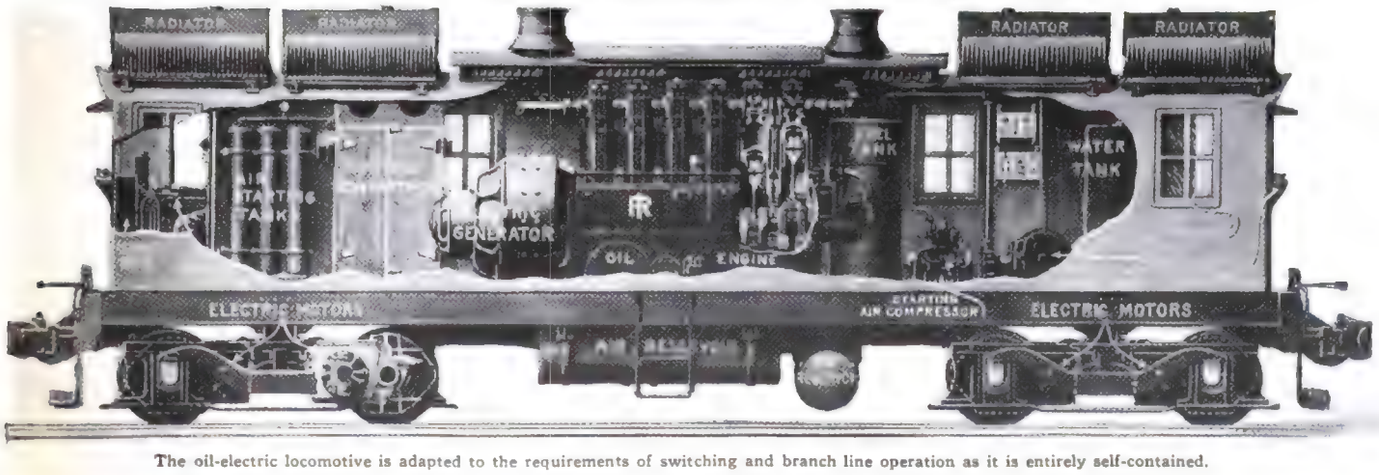
A prize contest announcement brought an ingenious walnut-branding machine to reorganize an industry.

Deadly Blow-Gun

Among other novel trophies gathered in the interior of South America by W. C. Porterfield and presented to the Los Angeles Museum of Arts and Sciences, is this blow-gun used with deadly effect by the Girbaro head-hunters.

A Power-House on Wheels

THE latest type of oil-electric locomotive developed by an American concern is a veritable power-house on wheels. The prime mover is one or more oil engines, direct-connected to a direct-current generator, which supplies electrical energy to traction motors mounted on the trucks. The oil engine is of the vertical, six-cylinder, 4-cycle, single-acting, variable speed type, having direct fuel-oil injection. Cylinders, cylinder heads and combustion chambers are completely water jacketed. Ignition is produced by the heat of compression only. The generator is a six-hundred volt unit. With this type of generator, the control of the locomotive becomes extremely simple; as no rheostats are used in the power circuit, the loss of power during acceleration is reduced to a minimum. The one outstanding virtue of this locomotive is that it is entirely self-contained, and is completely independent of outside sources of power.—Photo Ingersoll-Rand.



The oil-electric locomotive is adapted to the requirements of switching and branch line operation as it is entirely self-contained.

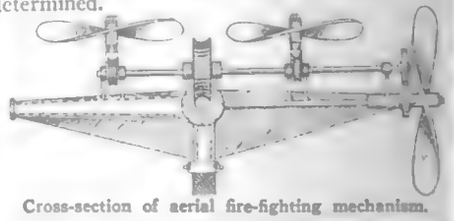
Fighting Flames from the Air

Pressure of a Stream of Water Carries the Hose to a Higher Elevation

By JOSEPH H. KRAUS

AN extremely ingenious device for fire-fighting particularly adaptable to the quelling of conflagrations occurring in some of the taller modern buildings has been invented by Edward P. Conlin of Girard, Ohio. It is well known that modern fire departments and fire-fighting devices are provided with engine-driven pumps producing a terrific pressure on the water forced through the hose and nozzle. Towers have also been made so as to direct the stream into the burning building with a greater degree of accuracy and with the assurance that the water will more directly reach the base of the flame. Mr. Conlin employs the pressure of the water to operate or energize two lifting propellers, the purpose of which is to carry the hose to heights unattainable with present apparatus, and he also has a propeller mounted at the back of the mechanism which will drive the fire-fighting appliance forward, in order to counteract the repellant action of the water.

Our artist has graphically portrayed how this type of an aerial fire-fighting mechanism could be employed in extinguishing a more or less serious conflagration in one of the modern skyscrapers. The peculiar V-shaped structures provided with the propellers are permitted to rise by their own power to a height greater than the floor level which the water is to reach. Even though the water may not pour out of the nozzle at a high pressure, it becomes evident from this drawing that the floor space could be completely drenched with water and the fire could in this manner be quenched. The question of properly directing the water must of course be taken into consideration. This could be accomplished by the aid of a grip provided with a suitable handle and surrounding the hose at its base. By twisting the hose, the entire mechanism at the top could likewise be made to swerve from side to side. The two web-like strengthening members are for the purpose of making the device more rigid and also assist in preventing oscillation of the appliance. The diagram below is a cross-section through the mechanism. The water coming up through the hose operates a water-wheel, which in turn is secured to a worm gear. The worm functions with another gear communicating with the two lifting propellers and also connecting with the propeller at the back for counteracting the repellant force of the water. The ratio of the gears and the design of the propeller must be experimentally determined.

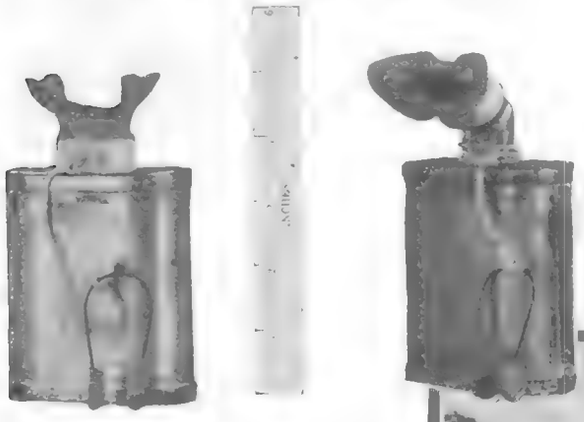


Cross-section of aerial fire-fighting mechanism.

Above is an artist's conception of how the new aerial fire-fighting mechanisms will look when in operation. These are structures employing two lifting propellers and a driving propeller and are operated by pressure of water in the hose. They lift the hose to the desired height.

Gas Masks Used by Railroad Crews

A very recent invention of considerable industrial value is represented in the photo below. It is a small size gas mask which is adjusted as shown in the photograph in the right upper photo. Rubber leaves fitted between the teeth support it.



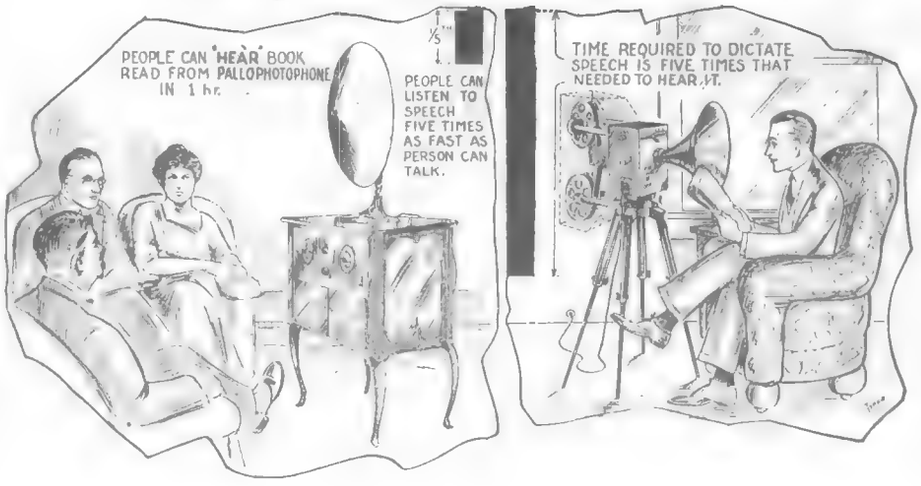
A GREAT need for a small, easily portable gas mask has long been felt in connection with railroad work. One such mask has been developed for use by train crews and yard employes of the Baltimore and Ohio Railroad. The mask consists of a canister which may be easily carried in the pocket, which is filled with an absorbent whose function is to make the gas-laden air breathable. The bottom of this cannister is perforated with small holes which permit the air to enter and pass through a filter. Rubber lugs and leaves are gripped by the teeth to prevent gas leakage.

THE bottom of this canister is perforated with small holes above which is a screen to retain the granular charcoal and soda lime absorbent. Less than one-half pint of absorbent is used in each. On top of the absorbent is a piece of toweling to serve as a filter, then a stiff wire screen held rigidly upon the absorbent by springs. A flat-metal collar is soldered to the wall inside half-way up and extends one-quarter inch towards the center. When the canister is placed in the mouth, the rubber leaves fit between the lips and teeth, the lugs are gripped by the teeth, and breath passes in and out by the canister.

At the left, the larger gas masks are extensively employed by train crews which are faced with the necessity of working under conditions where there is a great deal of smoke or gas in the air. At the top, the adjustment of the small canister may be easily seen. A small clamp is placed on the nose to close the nostrils. It will be seen that it is not necessary to hold the canister in the hand. Above, a trackman wearing gas mask at the mouth of the Schenley B. & O. tunnel in smoke after train has passed.

Reading Books At High Speed

DR. W. R. WHITNEY of the General Electric Research Laboratories proposed in an interview, a new use for the highly efficient method of recording recently developed in his laboratory. He suggests an electric book reader. The elementary apparatus for this device already exists; all that is necessary is a proper assembly. First, there is the "pallophotophone," which makes it possible to photograph sounds on a motion picture film by

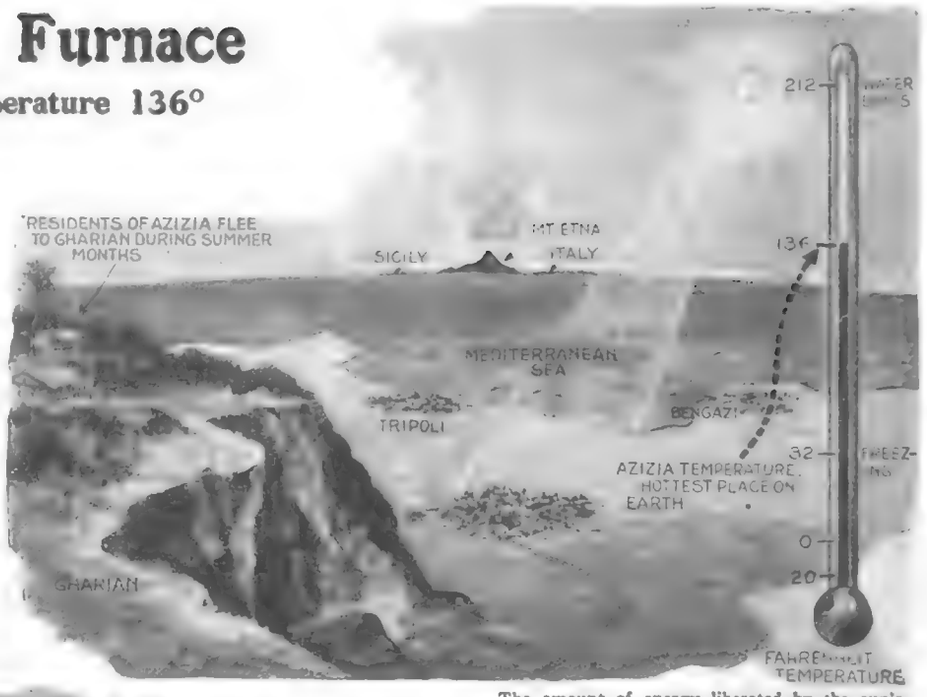

PEOPLE CAN 'HEAR' BOOK READ FROM PALLOPHOTOPHONE IN 1 hr.
PEOPLE CAN LISTEN TO SPEECH FIVE TIMES AS FAST AS PERSON CAN TALK.
TIME REQUIRED TO DICTATE SPEECH IS FIVE TIMES THAT NEEDED TO HEAR IT.

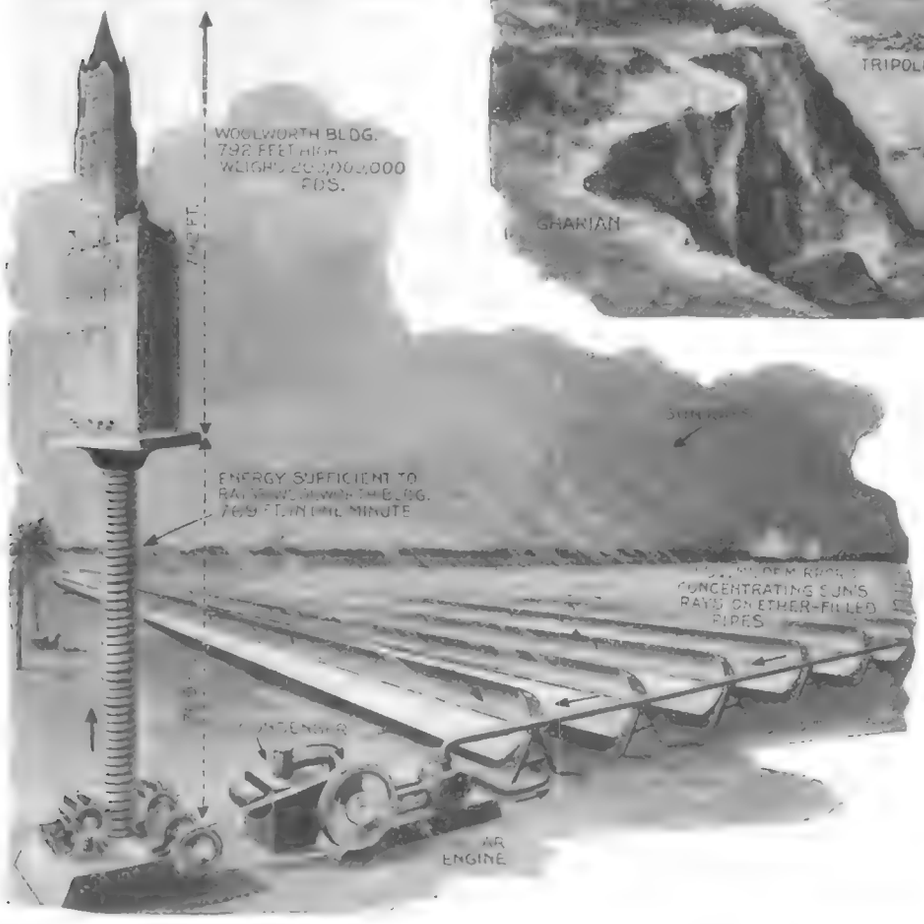
means of a photo electric cell which translates electrical impulses into light rays or light rays into electrical impulses. Then there are numerous loud-speakers which preserve nearly all the natural tones of the voice. It would seem a simple matter to record a long novel on a short stretch of film, and with a projector and loud-speaker, have it read as rapidly as we desire. It is said that we can understand the electric reader at five times the rate of ordinary talking.

The World's Furnace

Average Annual Temperature 136°

The illustration at the right shows a bird's-eye view of the portion of Northern Africa in the vicinity of Azizia. Azizia, a desert village 25 miles south of the City of Tripoli, has an average annual temperature which is the highest of that of any region on earth. Last year tests indicated an average temperature of 136° Fahrenheit. The inhabitants of Azizia leave their homes for the town of Gharian in a more temperate situation during the hot season.

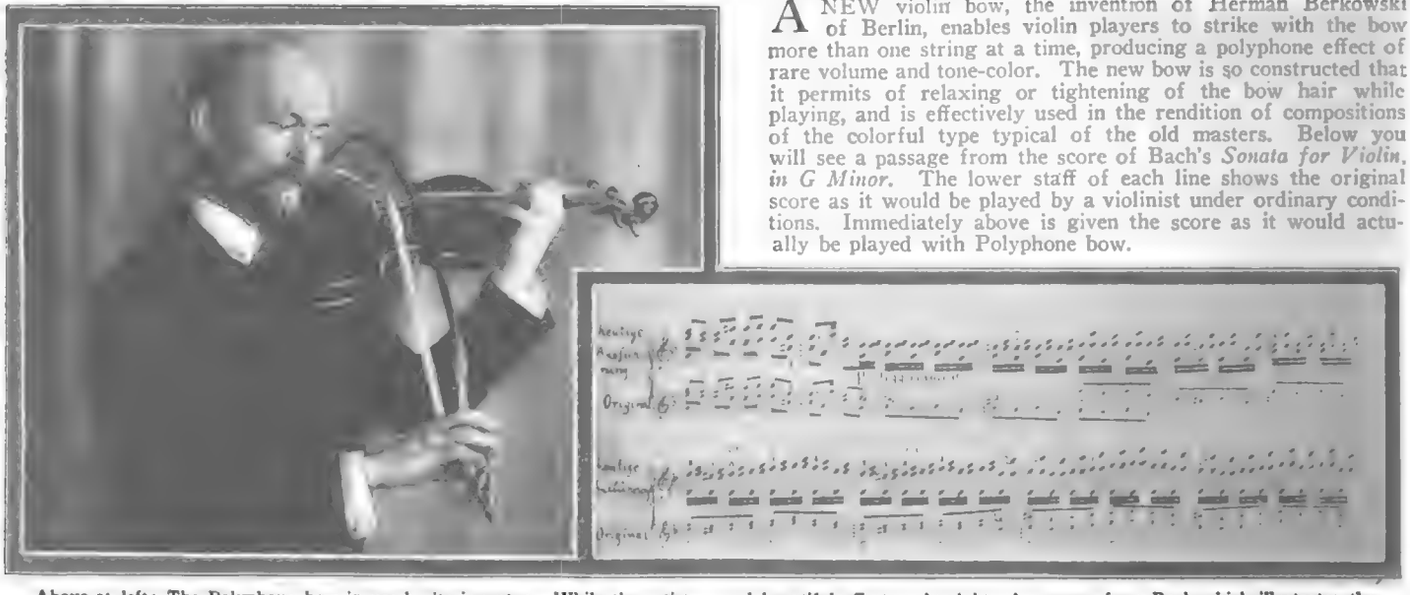



WOOLWORTH BLDG.
792 FEET HIGH
WEIGHS 268,000,000 LBS.
792 FT.
ENERGY SUFFICIENT TO RAISE WOOLWORTH BLDG. 769 FT. IN ONE MINUTE
CONCENTRATING SUN'S RAYS ON ETHER-FILLED PIPES
AIR ENGINE

The amount of energy liberated by the sun's rays falling on 1 square mile of territory in the latitude of Azizia is sufficient—if it were usable—to raise the Woolworth Building nearly its own height every minute of daylight. At the left is our artist's conception of a solar energy engine which might be used to convert the sun's rays into usable heat.

WE used to say that the world's hottest place was Wargla, in the Algerian Sahara (127° Fahrenheit), afterwards it was Death Valley, Calif. (134°), and now we have Azizia, an inland town of Italian Tripoli which boasts a summer temperature of 136.4° Fahrenheit. Azizia is a desert village situated about 25 miles inland from the city of Tripoli on the Mediterranean. A railroad runs between the city of Tripoli and Azizia into the Jebel, a cliff-like escarpment of the Sahara plateau. The top of the Jebel is about 2,000 feet above sea level. Gharian, a town of importance in Roman times, is a refuge for the inhabitants of Azizia, due to its cooler position on the crest of the Jebel. The tremendous energy of the sun's rays constantly falling on Azizia has been estimated at 4,663.500 horsepower.

Playing on Three Violin Strings At Once



A NEW violin bow, the invention of Herman Berkowski of Berlin, enables violin players to strike with the bow more than one string at a time, producing a polyphone effect of rare volume and tone-color. The new bow is so constructed that it permits of relaxing or tightening of the bow hair while playing, and is effectively used in the rendition of compositions of the colorful type typical of the old masters. Below you will see a passage from the score of Bach's *Sonata for Violin, in G Minor.* The lower staff of each line shows the original score as it would be played by a violinist under ordinary conditions. Immediately above is given the score as it would actually be played with Polyphone bow.

Above at left: The Polyphone bow in use by its inventor. While the artist can play two notes at a time with the usual bow by "Double-stopping," this bow makes it possible to play three notes at a time and to achieve unusual and beautiful effects. At right: A passage from Bach which illustrates the effect obtainable with this bow. The lower staff illustrates the original score, the upper the final effect as produced with this bow.

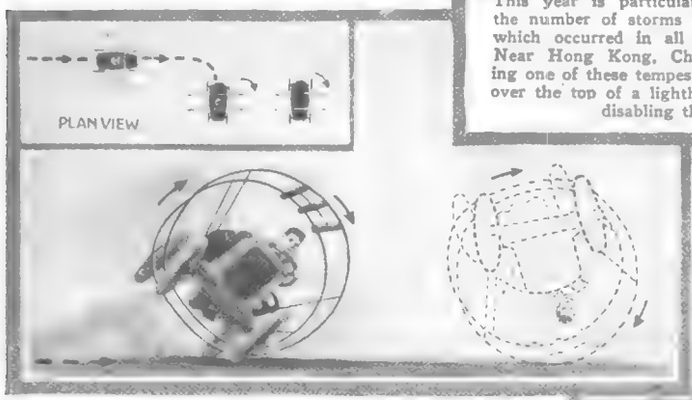
The Month's Scientific News Illustrated

By GEORGE WALL

The new Presbyterian Medical Center at 168th St. and Broadway, New York City, will contain some of the latest and most important developments in medical apparatus. The oxygen tent illustrated here, the invention of Dr. Alvan L. Barach, is expected to decrease the number of deaths from pneumonia.

This year is particularly characterized by the number of storms and marine disasters which occurred in all parts of the world. Near Hong Kong, China, the waves during one of these tempests in October dashed over the top of a lighthouse, 140 feet high, disabling the light.

Paris dressmakers, always ingenious, have arrived at the conclusion that the most portly of the fair sex may be convinced of their nymph-like proportions if they are induced to try on the latest styles before a convex mirror.

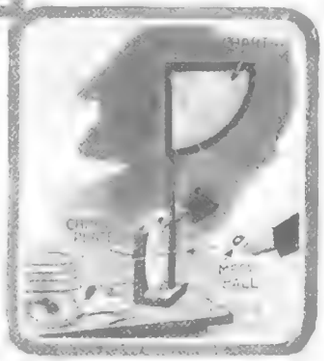


Looping the loop in automobiles is one of the latest and most thrilling of outdoor sports. It requires a technique of its own, and the car must be of special design to prevent fatal accidents. Andre Mercier does the trick with his Peugeot by the method shown above.

Cylindrical houses are being erected in Germany to solve the housing problem. The houses are of standardized construction, all sections being interchangeable. Standardization makes high-speed erection possible.

Klaas Everts, deep sea diver, took a practice stroll recently across the bottom of the Elizabeth River, between Norfolk and Portsmouth, Va. He claims he is going into training to walk across the English Channel.

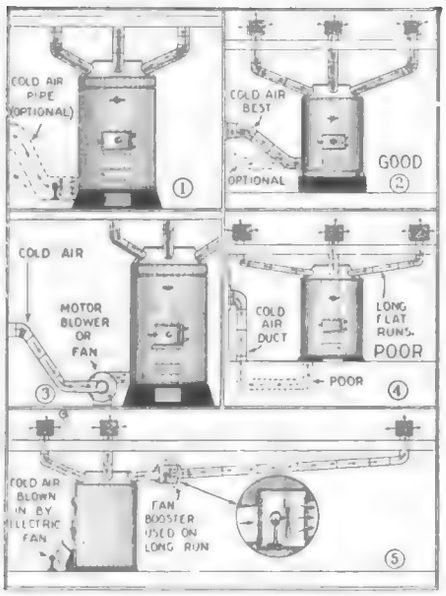
A Lincoln, Neb., aircraft company purchased a farm for use as an experimental test field, but the owner of the farm next door built an elevated rifle range to scare the aviators away from his line, but found this too expensive a proposition. Now he has a 45-foot wire fence on his property line which effectually discourages aviators.



One of the most peculiar jobs at the Bureau of Standards is held by Mr. R. B. Fair. His job consists entirely of breaking china. He uses the apparatus illustrated above to test the resisting power of china dishware purchased for use in the army and navy. The angle through which the metal ball must fall to break the dish under test is used as an index of the power of the china to resist years of careless handling.

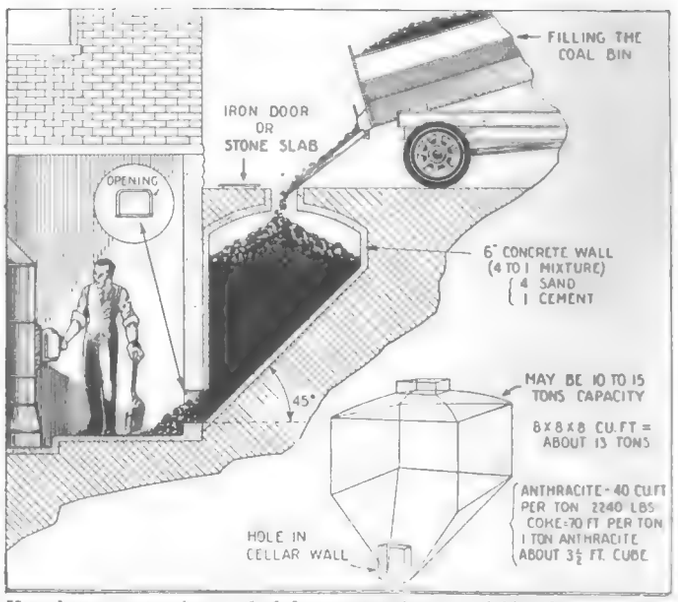
Hints On Home Heating

By H. WINFIELD SECOR



Several important points about warm air heating installations are shown above. Cold air may be taken from cellar aided by electric fan when necessary. Warm air pipes should have good upward angle, as at 2; 4 shows poor installation; 3 shows good cold air pipe with optional fan or blower; and 5 shows booster fan to help circulation on long runs. Short runs need to be shut off sometimes until warm air flows freely through long pipe.

A NUMBER of practical hints of value to home builders and those contemplating changes in their heating system are illustrated in the accompanying pictures. Figs. 1 to 5 in the illustration above show some practical hints for those operating or about to install warm air furnaces. For the small bungalow having three or four rooms on a floor, the pipeless warm air furnace fills the bill quite nicely. There are two types of these furnaces, the first one drawing a supply of cold air through the outer part of the large, single floor register. Personally the writer does not care for this type, as it is liable to cause draughts, but the second type does away with this objection by taking the cold air supply from the cellar. As shown in the drawings above, it is always desirable, if success is to be obtained with warm air heating, to see that the warm air pipes branching out from the top of the furnace have a good upward angle. Where the cellar has a low ceiling it may seem difficult to do this, but it is an apparently easy matter to sink a pit in the center of the floor large enough to accommodate the furnace, and give room to open the ash pit door. This pit may be from one to two feet in depth or more, and in this way the warm air pipes can be carried upward at a goodly angle, not less than thirty degrees whenever possible. Every effort should be made in placing a warm air furnace, so that it is as near as possible to the center of the pipe distributing system. When this is not possible, the registers or dampers on the short pipe line, or at least some of them, will have to be closed temporarily until the long pipe runs start passing the air out of their registers freely, when the short ones, or at least those shut off, may be opened up. A simple way to obviate this trouble is to place a small electric fan in the long run lines to act as a booster. It is advisable also to use a booster fan before the cold air opening of the furnace (or in front of the bottom draught door on steam, hot water or vapor furnaces), especially for use on dull days, when the furnace does not seem to draw well. Speaking of the long warm air pipe lines, another trick to help improve the circulation, which will obviate cutting the pipe line and placing a fan in a box inserted in the line, as shown in Fig. 5, is to place an electric fan with its back to the register opening on such a long line. The fan thus placed will help to suck the warm air up through the long pipe line and blow it out into the room.


FILLING THE COAL BIN
IRON DOOR OR STONE SLAB
OPENING
6" CONCRETE WALL (4 TO 1 MIXTURE) 4 SAND 1 CEMENT
45°
MAY BE 10 TO 15 TONS CAPACITY
8X8X8 CU.FT = ABOUT 15 TONS
ANTHRACITE - 40 CU.FT PER TON 2240 LBS
COKE - 70 FT PER TON
1 TON ANTHRACITE ABOUT 3½ FT. CUBE
HOLE IN CELLAR WALL

Here is a space saving method for constructing a coal bin of concrete, external to your cellar. The sides are so shaped that the coal will always feed toward the opening in the cellar wall, as becomes apparent.

Electric fans find a variety of uses in the winter time, one of which is shown below. Here the fan is placed so as to blow against the lower part of the steam or hot water radiator, so as to cause a circulation of the air in the room, the air being warmed as it is rapidly blown over the heated radiator.

Several other useful wrinkles for the householder and office worker as well, are shown in the picture below. If you have warm air heating in your home, you should place several fruit jars filled with water, and with the tops open, back of your piano. It cost the writer $50.00 a few seasons ago, to have the cracks all filled up in the sounding board of his piano by an expert, due to the extreme dryness of the air. Another trick is to place strips of cloth over a wire frame, the cloth dipping into a pan of water, as shown in the picture below; the whole device being placed before a warm air register. Water pans may be purchased on the market suitable

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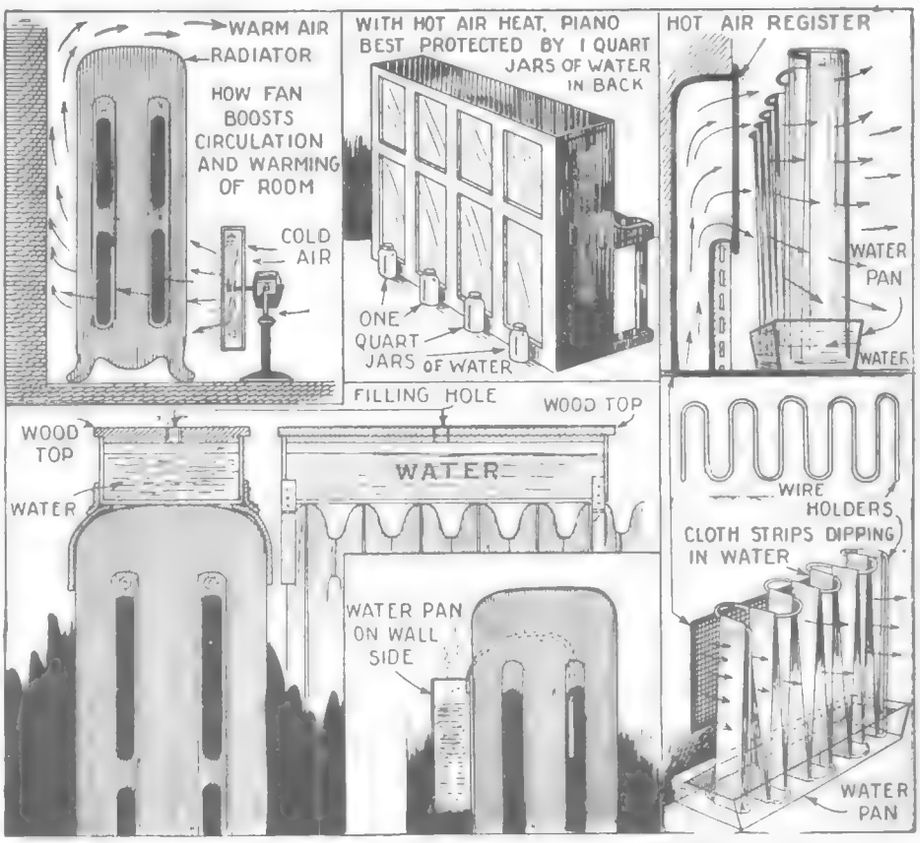
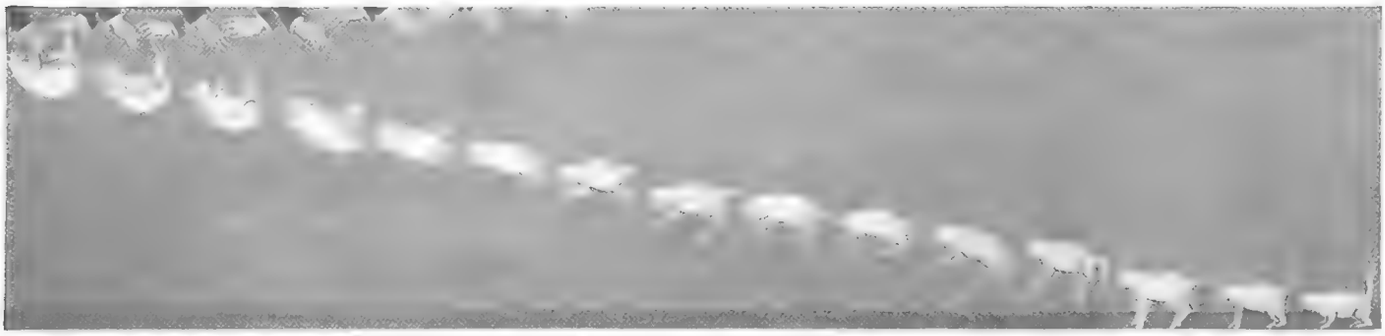


The problem of properly humidifying the air, whether from warm air registers, or from steam or hot water radiators, can be solved by one of the methods illustrated above or a combination of them.

Why a Cat Always Lands on Its Feet

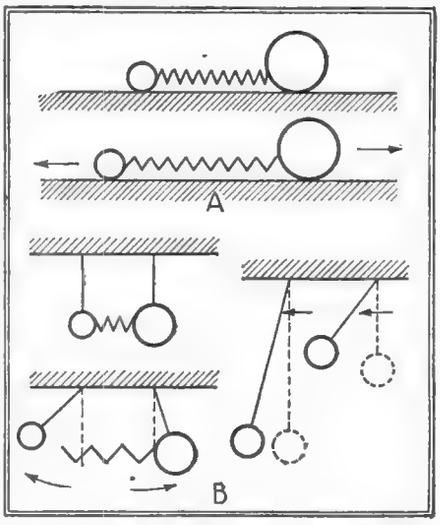


Have you ever noticed that a cat always manages to land on all four feet when it is unlucky enough to fall from even an insignificant height? Probably you have wondered what peculiar contortions the cat went through to enable it to land safely. The drawing above shows exactly what the cat does at every instant of its drop. The turn may be accomplished even if the fall is only through a distance of two or three feet.

CONSIDER a diver who wants to dive head first from a great height; keeping his body straight, he lets himself fall into the water, giving himself a slight impetus with his feet. The amount of this impulse determines the success of the dive. Too weak, the diver would not turn sufficiently, he falls flat; too strong an impulse, he will turn too far and fall on his back. If in the midst of his descent he realizes that he is not turning sufficiently, he can do nothing but make a bad dive.

Now everybody knows that a cat which falls accidentally from the top of a wall comes down on its feet. There is no mystery about it; it is all due to the formation of the muscular system in its body.

Now we are going to see that it is possible for the cat to perform motions, due to the suppleness and the construction of its body, which are practically impossible in the case of man. They may seem impossible even in the case of the cat, but a review of the following principles will make the idea clear.



A, two balls of unequal weight, before and after the spring has acted. B, pendulums of unequal weight before and after the action of the spring, and the effect of differing rod-lengths.

Suppose two balls of unequal size rest on a table with a compressed spring between them. When the spring is released, the smaller ball will be driven a greater distance.

Now hang the two balls by threads of the same length and repeat the experiment with the spring. Again we find the small ball will travel a greater distance when the spring is allowed to act upon it. In such a case physicists speak of the moment of inertia, not of the masses alone. Now suppose balls of equal size are suspended by rods of unequal length. If the rods are struck at the same distance from the suspending point, and with equal force the short pendulum will

(*Continued on page* 1063)

The Largest Flower in the World

Thirty-two days after planting, the Giant Amorphophalle presented the appearance of a spire 34 inches in height, as in the photograph above.

ON the Island of Sumatra, in the Dutch East Indies, some of the most exotic and curious plants are to be found growing wild. It is here that we must look for the largest flower in the world. On the 19th of March, 1925, a scientist planted a large bud of the Giant Amorphophalle. Twenty-two days later it was 22 inches high. It continued to grow and on June 24th at midday, the point of the spathe began to unroll itself, and four hours later the flower,

The Giant Amorphophalle blooming in a Java garden, June 24, 1925. The stick is 2 meters long and the flower 6 feet 6 inches in height.

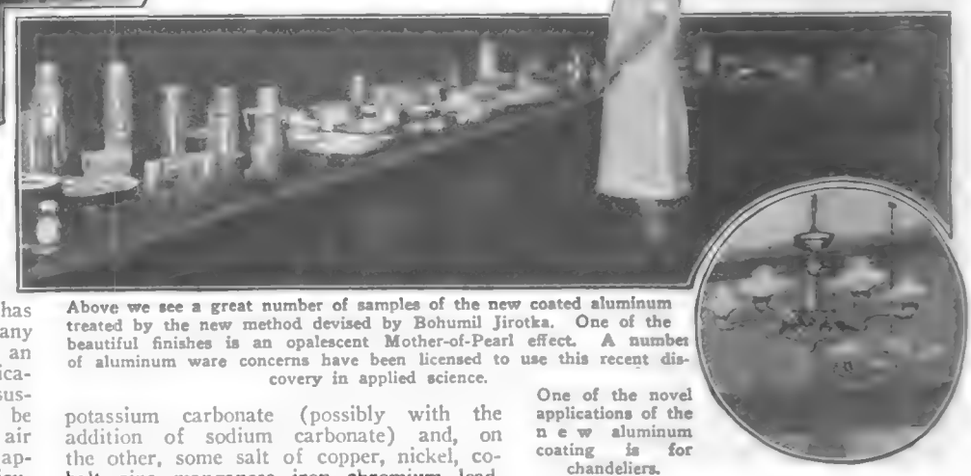
In March, 1926, the Amorphophalle presented the appearance of a small tree about 10 feet tall. The plant blooms but once in its lifetime.

which then had a height of about 6 feet 6 inches, appeared in all its beauty. M. Dakkus, the scientist conducting the experiment, fortunately took the trouble to photograph the Amorphophalle in its whole expansive bloom, so as to preserve for us the fragile beauty of this rare and transient bloom.

CORROSION-PROOF ALUMINUM AT LAST

By DR. ALFRED GRADENWITZ

Photograph above shows Bohumil Jirotka, the inventor of a remarkable new method of coating aluminum and duralumin with a heatproof color finish. This coating is available in many colors and will stand extreme bending.



Above we see a great number of samples of the new coated aluminum treated by the new method devised by Bohumil Jirotka. One of the beautiful finishes is an opalescent Mother-of-Pearl effect. A number of aluminum ware concerns have been licensed to use this recent discovery in applied science.

One of the novel applications of the new aluminum coating is for chandeliers.

ALUMINUM, which of late years has been so widely used for so many different purposes, could find an even much larger field of application if its principal drawback, viz. its susceptibility to atmospheric agents, could be overcome. In fact, a short exposure to air generally suffices to spoil the pleasing appearance of the metal, which is a particularly unwelcome feature in connection with kitchen utensils made of that metal, while a few months' service in the case of automobile bodies, airplane wings, etc., made of aluminum or duralumin, one of its alloys, often results in such serious corrosion as to jeopardize their mechanical strength.

It has, therefore, long been thought that articles made of aluminum or an aluminum alloy should be coated with some heavy metal such as copper, tin or zinc, to protect it against corrosion and make it more durable and the use of suitable electrolytic baths has been advocated in this connection, but apart from the necessity of a thorough cleaning previous to the application of the electric current, such a process is expensive and complicated and does not always secure a firmly adhering surface coating.

Far better results are obtained with a trifling outlay by means of a simple chemical process devised by Bohumil Jirotka, which at the same time affords a most welcome means of varying and decorating at will the surface of any aluminum object. Several hundreds of different baths have so far been prepared and tested; many colors and hues, as well as any surface finish, both matte and polished, uniform or opalescent, are obtainable at slight cost.

One fact which greatly simplifies operation is that the article to be coated need not by any means be cleaned before its being immersed into the chemical solution.

Some of the first baths used by the inventor contained, on the one hand, potassium carbonate (possibly with the addition of sodium carbonate) and, on the other, some salt of copper, nickel, cobalt, zinc, manganese, iron, chromium, lead, bismuth, tin, silver, gold or some other metal electro-negative to aluminum and which was to constitute the coating. Compounds soluble in water and liberating oxygen, in particular some chromate, may be added to the bath, and bicarbonates of alkali metals can be used side by side with the carbonates. A mixed deposit of chromium and silver is obtained by means of a solution containing in one litre of water, 10 grams of chromium sulphate, 2 grams of silver nitrate, 10 grams of potassium carbonate, 3.3 grams of sodium bicarbonate and 3.3 grams of potassium bicarbonate. While this bath is used in connection with soft aluminum, a solution containing three times as much of each constituent has been found preferable in the case of duralumin. The coatings thus obtained can be made brighter by an addition of about 10-20% of glycerine.

While the long list of solutions used in the various cases cannot here be enumerated, it may be said that no poisonous compounds, such as cyanides, and no expensive salts, such as those of ammonia, are used. The process is altogether independent of the application of any electric current, the action being purely chemical, and only when a particularly thick and resisting coating is desired will it be found advisable to reinforce the chemical coating by an additional surface layer applied by galvanic means, which, of course, will cling much more firmly to underlying chemical coating, than if it had been produced direct on the aluminum surface.

The chemical bath is contained in a vat of suitable dimension which comprises heating coils for raising the solution to a suitable temperature. While the chemical action is, of course, accelerated by a rise in temperature (up to a point close to boiling), the best effects are in certain cases obtained by a bath kept at room or moderately high temperature. A few minutes (sometimes even less) is the time generally required to secure a satisfactory coating covering the whole surface of the article and penetrating into any fissures or cavities.

Operating expenses are very low, the coating of one square yard entailing an expenditure of but 1 to 2 cents.

A perfect coating of a greyish blue, resembling glazed procelain, has been found most suitable in connection with motor-car bodies. This has a high brilliancy, is resistant to mechanical injury and can be washed with hot or cold water. Unlike the usual varnish coating, which it takes several weeks to apply and dry, it will be ready for use after a few minutes. The same coating can be used in connection with any other vehicles such as railroad cars and airplanes; while ship outfits made of aluminum will be protected by means of similar coatings

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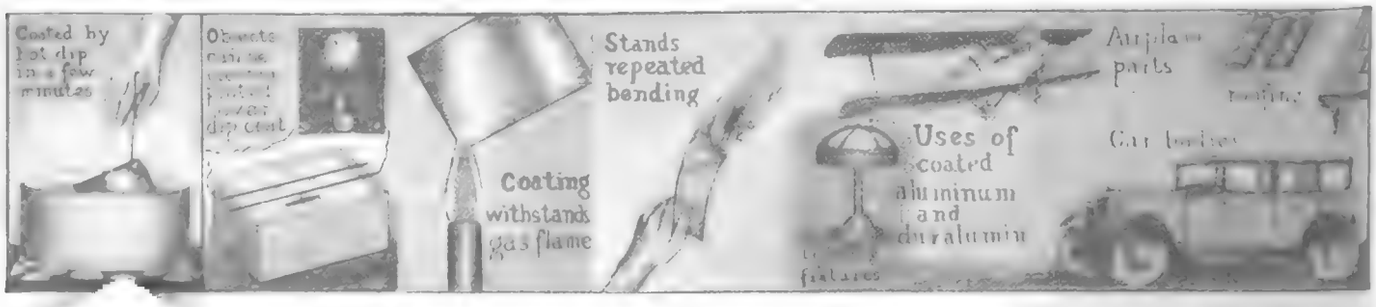

Coated by hot dip in a few minutes
Stands repeated bending
Coating withstands gas flame
Uses of coated aluminum and duralumin
Airplane parts
Car bodies

Picture above shows how the new aluminum coating method the Jirotka process, and also a number of the practical applications of the new corrosion-proof coated aluminum. These applications include roof shingles, etc. The coating can be electroplated.

Propagation of Tree Cuttings in a Sterile Liquid

By COUNT A. N. MIRZAOFF

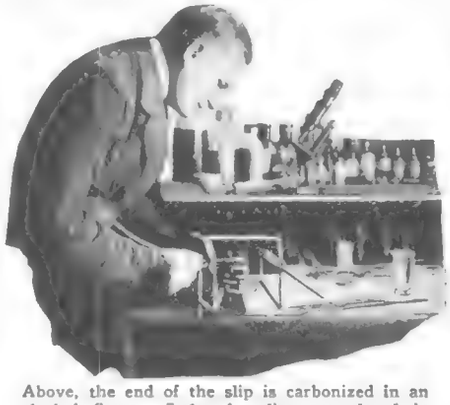
The surface of the slip is first brushed with 95% alcohol.

GARDENERS usually have incomplete success in propagating in the open air cuttings of certain trees. Accordingly they prefer to put the cuttings under bell-jars or in cold frames so as to regulate as desired transpiration, heat and humidity.

But certain French specialists of the present day now employ a more scientific method, propagation of cuttings in a sterile liquid medium, which seems to give very encouraging results. This is how it is carried out.

They begin by moistening the branches with ninety-five per cent alcohol. To do this they rub the surface of the slips with an ordinary brush and after this they slightly char the end of each of them by passing the end where it has been cut off through the flame of a little alcohol lamp, and then they coat the charred end with paraffin wax.

When this has been completed, the cuttings thus prepared, are put into a vessel containing a solution, one in a thousand of corrosive sublimate, or else of formaldehyde, one-half of one per cent. strength, and leaving them in this receptacle for several months covered with a thin cloth.



Above, the end of the slip is carbonized in an alcohol flame. Left, the slips are placed in a jar of ½ of 1% formaldehyde. Right, in two weeks the slips are budded and ready to be placed in the ground for rooting.

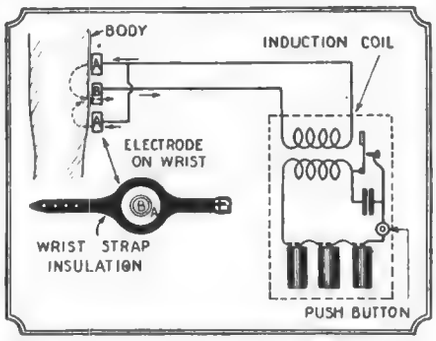
Paraffin is applied to the end of the slip where it has been previously carbonized.

At the expiration of this time, the cuttings will have put forth leaves and all that remains to be done is to plant them and they will develop roots. This simple and rational process is now employed by several Parisian gardeners and succeeds excellently. It can be used for propagating almost all trees and shrubs, such as willows, Lombardy poplars and other trees to be found in French gardens. The system economizes space as it dispenses with frames and pots.

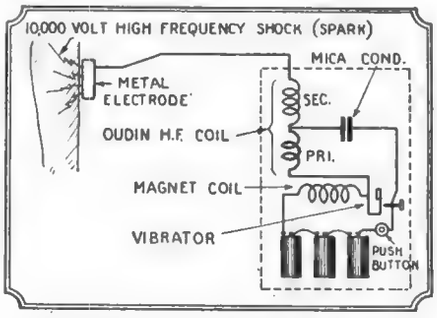
Electric Wristlet Baffles Assailants

By the use of an electric wrist band, similar in shape to a wrist watch and strap it is said to be possible to disable an attacker by rendering him temporarily unconscious.

A GREAT many very useful protective devices have been developed recently for use against thugs and bandits. We recently published in these columns a description of a gas pistol made in the form of a fountain pen, the use of which rendered the victim powerless and subject to easy arrest. This month we are illustrating another device which employs high frequency, high voltage electricity to accomplish its object. The device is very compact, being about the same size and the same shape as a wrist watch, and



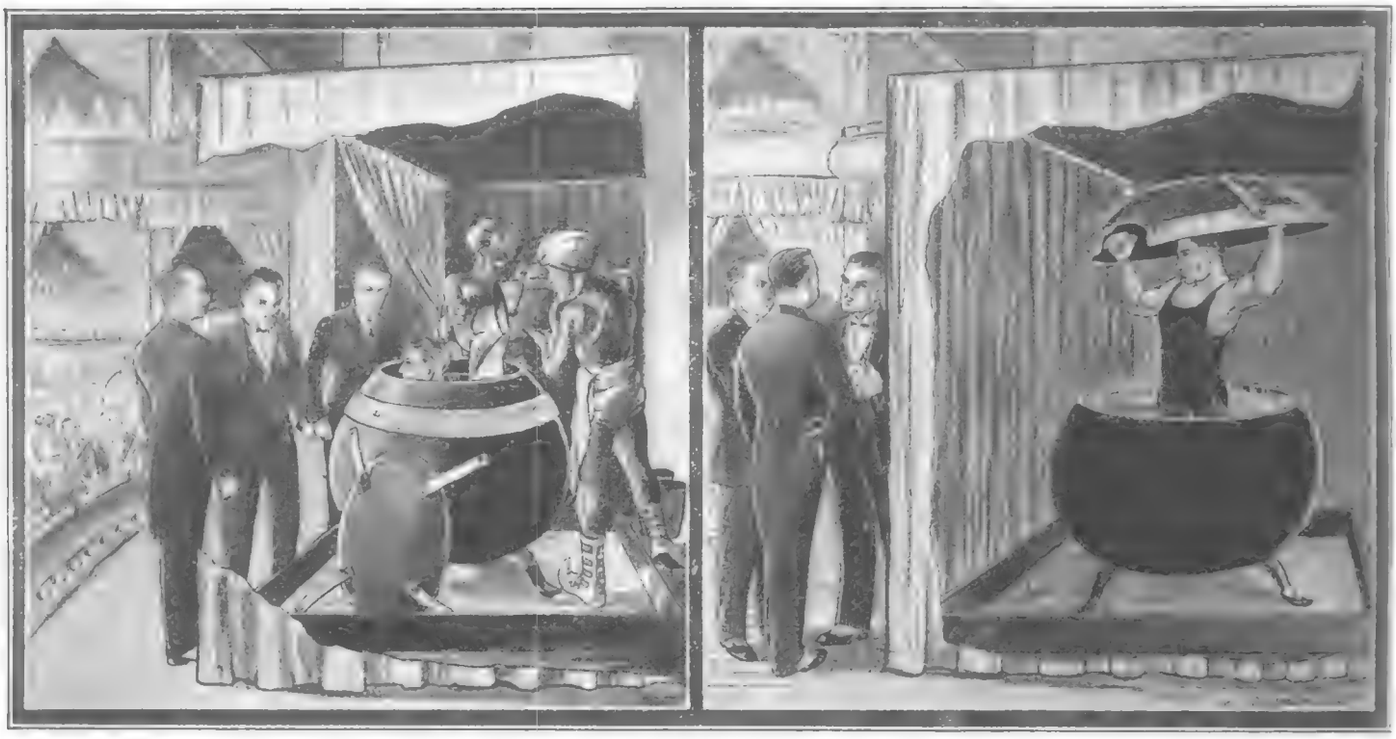
One of the possible conections for such a protective device is shown by the above diagram. A spark coil is connected to the wrist band so that the assailant receives a shock when the circuit is closed.



Another possible combination involves the use of an Oudin high frequency coil, arranged so that the secondary is grounded through the body of the attacker. A high voltage spark is produced.

The inventor, Emil Pruss, is shown above wearing one of the "protectors." The device is said to be very effective, and harmless to the wearer.

it produces a current sufficient to cause a severe shock. Such a current may be produced by either of the two methods illustrated in the accompanying diagrams. The use of the spark coil is perhaps a simpler method, but a higher potential will be obtained by the use of a high frequency coil.



Somewhat similar to Houdini's famous milk-can trick, well-known to American audiences, is this illusion of Monsieur Steens, who is entertaining Parisians with the act illustrated herewith. After the magician's assistants filled the cauldron with water, he crawls inside and the cap is locked and sealed on by a committee from the audience. The picture at right above shows how the magician raises the whole top of the cauldron, thus making his escape, and at a signal the curtain is pulled back and there he stands outside the cauldron. How does he do it?—Read on.

Magician Escapes from Cauldron of Water

Well-Known Magician Entertains Parisians with Clever Trick

THE Magician Steens shows at the present time in various Parisian halls a new device of his creation which never fails to impress vividly the spectators. The artist jumps into the liquid which is contained in an enormous spherical boiler, and hides therein. He has hardly disappeared when an immense flame escapes from the boiler, rising up in lambent golden violet tongues.

The fire diminishes, goes out and presently, to the great astonishment of the public Steens rises up out of the boiler, free from all burns.

Again he disappears into the liquid and now some volunteers from the audience place upon the boiler a metal lid, which is screwed down securely. This time the diver is or certainly seems to be a prisoner.

Next for a few seconds a curtain surrounds the boiler. Then when the curtain falls to the ground, the public sees Steens standing up and smiling alongside of the magic boiler which he mysteriously escaped from, and whose lid is screwed down hermetically.

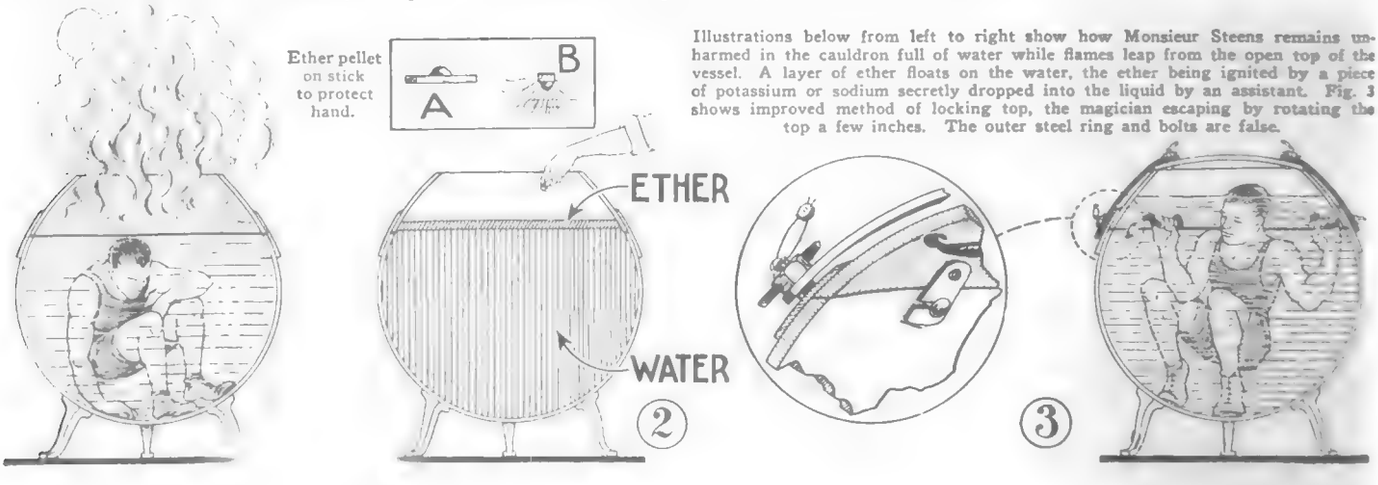
How can this sensational attraction be explained? A man remaining for a greater or longer period beneath the water, which is the liquid contained in the boiler, only presents a question of personal aptitude which requires no special faculty. As to the inflammability (apparent) of this liquid, the effect is obtained by pouring into the boiler a certain quantity of ether, which as it is very light, floats on top of the water, and is lighted by contact with a particle of potassium or sodium thrown in secretly by the assistant.

But when the cover is screwed down on the boiler how can Steens get out? Our two outlines seem to give clearly the key to the enigma; the upper part of the boiler has a detached segment. The line where the parts join is camouflaged by a band of metal. It is on top of the upper segment that the cover is screwed down by the spectators, but as in spite of appearances, this segment which is now the lower part of the upper section, simply rests upon the lower part of the boiler, nothing is easier for the performer than to push it up as he gets out of the boiler, and then to put back upon the lower section the movable wall and its cover, so as to appear in the posture of a miraculously escaped prisoner causing intense surprise among the spectators.

The foregoing story is translated from a French description in *Je sais tout* and the present illustrations show several improvements in this apparatus.

A trick well-known to stage magicians is shown added to the French design of this cauldron, as per drawings below. Two or three slotted projections engage with studs on the inside of the cauldron.

All the magician has to do after the committee has apparently locked him in securely and sealed the nuts, is to grasp the handles inside the cap and turn it a few degrees. He then gets out and replaces the cap, turning it so as to lock it firmly once more.

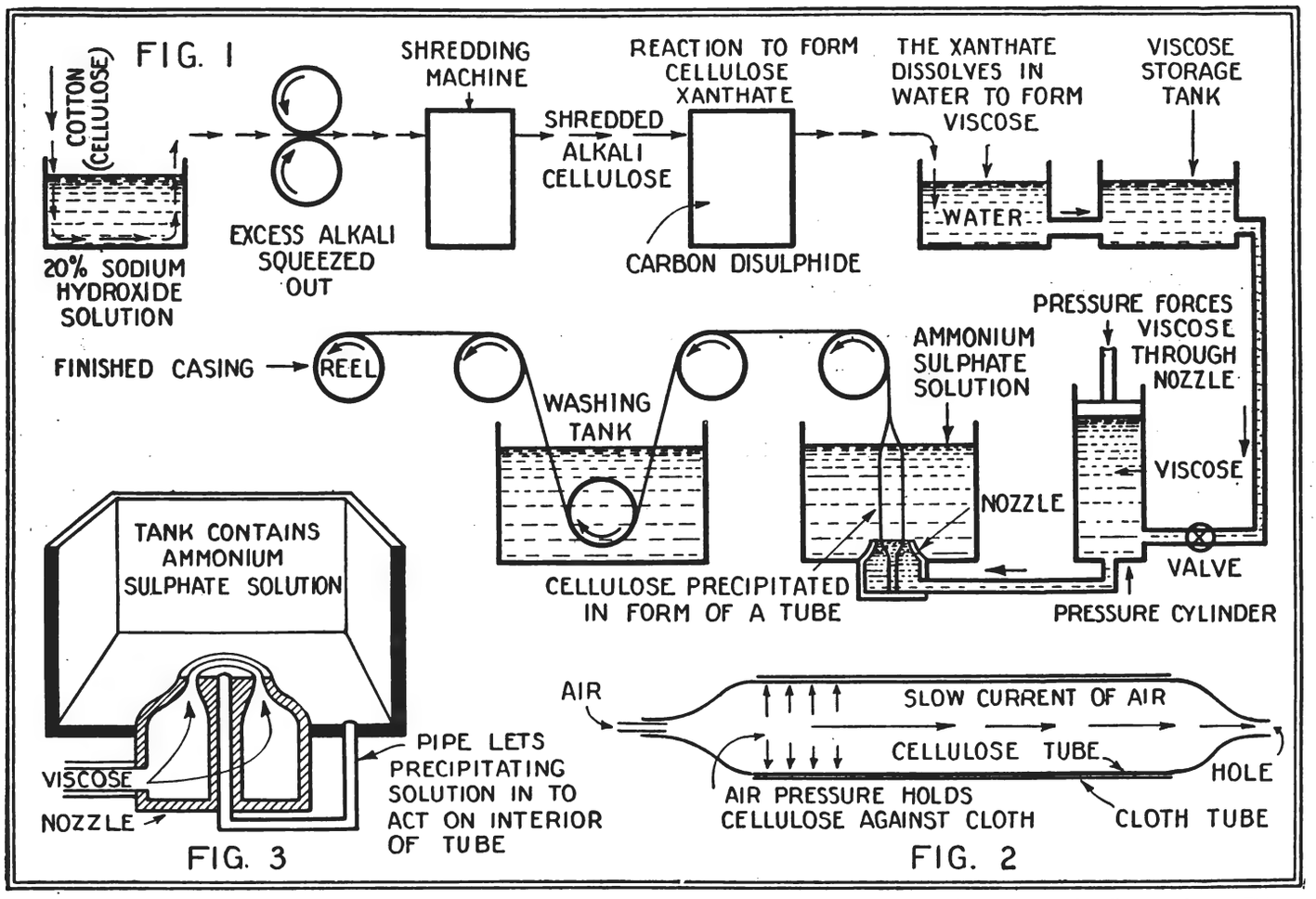


Illustrations below from left to right show how Monsieur Steens remains unharmed in the cauldron full of water while flames leap from the open top of the vessel. A layer of ether floats on the water, the ether being ignited by a piece of potassium or sodium secretly dropped into the liquid by an assistant. Fig. 3 shows improved method of locking top, the magician escaping by rotating the top a few inches. The outer steel ring and bolts are false.

Synthetic Sausage Skins

New Process Provides a Sanitary Cellulose Casing for Sausages, Frankfurters, Bolognas, and Other Similar Products

By D. B. McRAE



In former years the only coverings or casings available for sausages, frankfurters, and similar products, were those obtained from animal tissue. The newest synthetic casing for this purpose, made from cellulose, is evolved by the clever technical process shown in the progressive diagram above. This work is the result of researches by Messrs, Henderson and Dietrich, of the Mellon Institute at the University of Pittsburg.

A COMPLETELY hygienic sausage casing has at last been produced which does away with all the undesirable properties of the animal casings. The new casing is made of cellulose by a method worked out by William F. Henderson and Harold E. Dietrich at the Mellen Institute.

A carefully selected grade of pure cotton linters, which consists of practically pure cellulose, is chemically treated in such a way that it is converted into a fluid or plastic condition from which it can readily be converted back to pure cellulose. While in the fluid condition it is forced under pressure through a nozzle having an annular opening as shown in Fig. 3. This nozzle is placed in the bottom of a tank containing ammonium sulfate solution. As the viscose, as the solution of cellulose is called, flows out and upwards from the nozzle into the solution of ammonium sulfate, a reaction takes place which results in the cellulose being reprecipitated. Means are provided to withdraw the product as fast as it is formed.

Fig. 1, shows the details of the process from the time the original cotton is treated until the finished cellulose tubing is wound up on reels. The cotton is treated with 20% sodium hydroxide solution until it is thoroughly swelled. The excess alkali is then pressed out, the alkali-cellulose shredded, and then treated with carbon disulfide fumes to form a bright orange-colored product, cellulose xanthate, or cellulose dithiocarbonate. This product dissolves in water to form a syrupy solution, known as viscose. The viscose is allowed to stand for about eight days at a temperature of 10° C. to ripen before it is ready for use.

The ripened viscose is then run into a pressure cylinder from whence it is forced out through a pipe into the nozzle by means of pressure applied to a piston. As the seamless tube is precipitated by the ammonium sulfate solution it is continuously drawn away by a revolving drum and then passes over a series of drums which lead it through other tanks for washing or for any supplementary treatment that may be required.

In order to dry the tubing and keep it of uniform size without allowing it to bulge or shrink unevenly, an ingenious method was devised. The moist tube was placed inside of a thin cloth tube and was then inflated with air. Sufficient air pressure was used to keep the tube firmly inflated against the cloth tube which limited the swelling. A small hole was made in one end to allow a slow escape of air, thus allowing a current of air to flow through the tube. At the same time a fan blows a current of air over the outside. A 35-foot length of tubing can be dried in a very short time in this way.

Fresh Air and Bodily Temperature

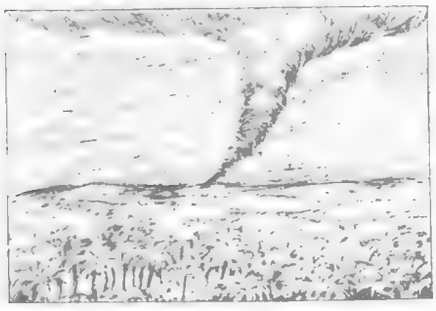
A curious conclusion has been reached by Prof. Winslow of the Yale School of Medicine concerning ventilation with special reference to schoolrooms. He speaks as Chairman of the New York Commission on Ventilation. The result of his investigations is that the deficiency of oxygen and the presence of excessive carbon dioxide does no harm. Subjects were exposed to the action of breathing the air in a sealed chamber. The oxygen of the air decreased. The carbon dioxide increased. Then they were supplied with pure air to breathe and the breathing of the pure air did them no good, after they had suffered from the action of the conditions of being sealed up and breathing the same air over and over again. Electric fans were then started and the air was set into motion. This reduced the temperature of the surface of the body, and at once improvement was shown. Long records of offices and the like showed an eighteen per cent. increase of absences due to sickness when the temperature was kept in the neighborhood of seventy degrees; compared with results at sixty to sixty-five degrees. The general conclusion is that it is more important to keep air in agitation rather than to try to keep it pure by forced ventilation.

The much scorned ceiling fans seem to be coming into their own.

Storms to Order for the Movies

By EDWIN SCHALLERT

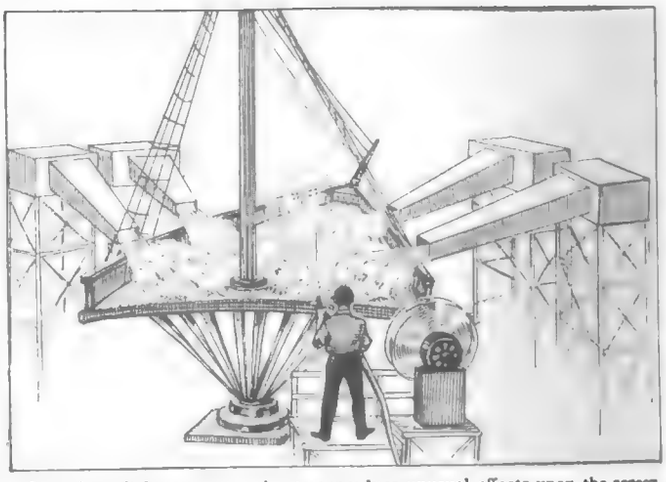
IT is probably a fact that participation in the motion-picture business requires more ingenuity and technical skill than almost any other industry. In many cases it is found necessary to duplicate in the studio those phenomena which Nature refuses to produce when they are most wanted. The garden-hose and wind-machine make a very creditable shower for a small set, but bigger problems require more thorough and scientific treatment. Sometimes it is absolutely impossible to produce the effects in full size, so the studio which possesses a good Model



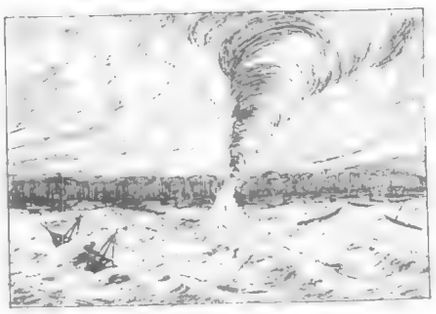
technician is indeed fortunate. The West Coast studio of the Famous Players-Lasky Corporation was recently faced with the problem of producing a storm involving tornadoes and water-spouts for the production of their new picture "Sea Horses". The problem was very ingeniously met through the use of models and trick photography, and the result upon the screen is an exceedingly realistic and awe-inspiring spectacle. The director of "Sea Horses", Mr. Allen Dwan,

called upon the technical department of the Lasky studio for assistance, and they employed the methods illustrated on this page to achieve their effects. The script of the story called for views of a water-spout in a harbor, the swamping of ships, a tornado in the jungle, and views of the scenes of devastation. The effect of the waves rising over the gunwales of the ship was produced by standard methods first employed several years ago in the production of Charles Ray's "The Courtship of Miles Standish." In the upper right hand corner of this page will be found an illustration of the apparatus employed, producing an effect similar to that illustrated at the head of this column. All the other effects were produced with special apparatus shown on this page.

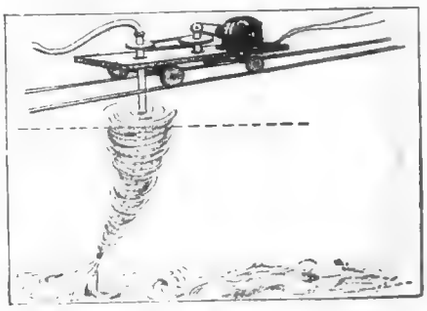
THE crashing waves which rose high over the bow of the ship were produced as shown at right by water flowing from reservoirs and a fire-hose on to the deck of a "prop" ship installed in the studio tank. The pictures were taken at slow speed to heighten the effect of realism, while those taken of a small scale model of the ship were made at high speed to slow down the motion of the water. The camera was occasionally reversed to give the effect of suction which is characteristic of big waves. The camera was mounted on an extension of the deck of the "prop" ship.



Sometimes it is very expensive to reproduce unusual effects upon the screen, as it was in this case where the bow of a ship was required to be constructed to full scale. A hydraulic pivot furnished the necessary rolling motion.

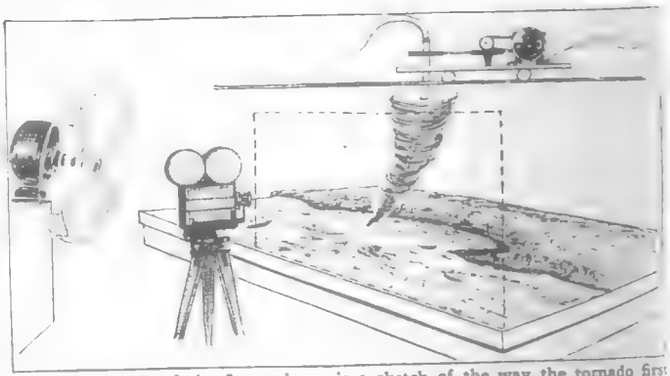


The mechanism shown at the right and described elsewhere on this page gave very good results in simulation of the appearance of the tornado's whirling cone. The dotted line indicates the limit of that portion within the range of the motion picture camera. Water

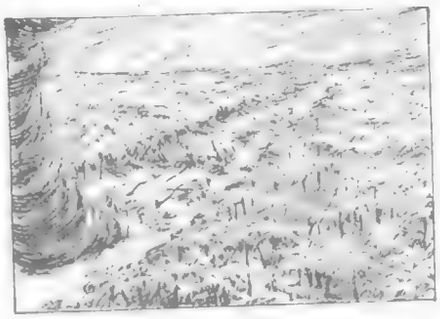


was now pumped through a rubber-hose inserted into the crepe-covered cone, and when the film was reversed, the water appeared to rise from the surface of the tank into the vortex of the tornado.

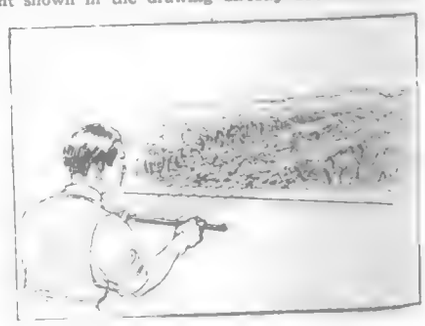
THE twister itself was produced by a motor-operated gyroscope to which was attached a spiral frame extending down to the miniature set. The frame was covered with loose folds of black crepe cloth, and was rotated at high speed by the gyroscope to give the effect of the pillar of vapor and dust typical of this kind of storm. A rubber hose was inserted in the frame to spray water vapor upon the water below.



In the middle of the first column is a sketch of the way the tornado first appears upon the screen. Later it is seen sweeping over the crowded harbor, destroying ships as it progresses. The latter "shots" were made with the arrangement shown in the drawing directly above.



The lower picture in the left-hand column illustrates the scene in which the ill-fated ship was lifted by the suction of the tornado upon the treacherous rocks, called "sea horses", which bordered part of the harbor. This is, of



course, a miniature set. The two drawings above give the appearance of one sequence in which the tornado passes through the forest. Thin wires, held by an operator, knocked down the trees to order.

To Explore Ocean Depths in Steel Tank

Dr. William Beebe, the Famous Explorer, Is Having a Steel Tank Built to Study Deep Sea Fish

THE accompanying illustration shows how Dr. William Beebe, well-known scientist and explorer, intends to study the denizens of the ocean's depths at first hand. He is having built a steel tank of the size shown in the detail drawing in the lower right hand corner of picture, so that he can be hauled along in this tank on the end of a steel cable at depths as great as one mile or more. Offhand the average person will probably think that he will see nothing new except the average species of fish, sharks, et cetera, but as was pointed out in a remarkable article by Dr. Ernest Bade in the March, 1919, number of this journal, many of the fish inhabiting the deep waters of the ocean, supply a light of their own. The artist in making the accompanying picture has enlarged the size of these self-luminous fish to give you a better idea of their appearance. Of course no one knows how big some of these fish may grow, as the depths of the sea contain, without a bit of doubt, many huge fish specimens which man has never seen as yet.

The steel tank being built for Dr. Beebe is so arranged that it will contain an oxygen supply and chemicals to absorb the carbon dioxide from the exhaled breath. In the first explorations, Dr. Beebe states that no electric light will be used, owing to the illumination afforded by the luminous organs of the deep sea fish. Later Dr. Beebe expects to use a strong searchlight so as to take motion pictures at these great depths.

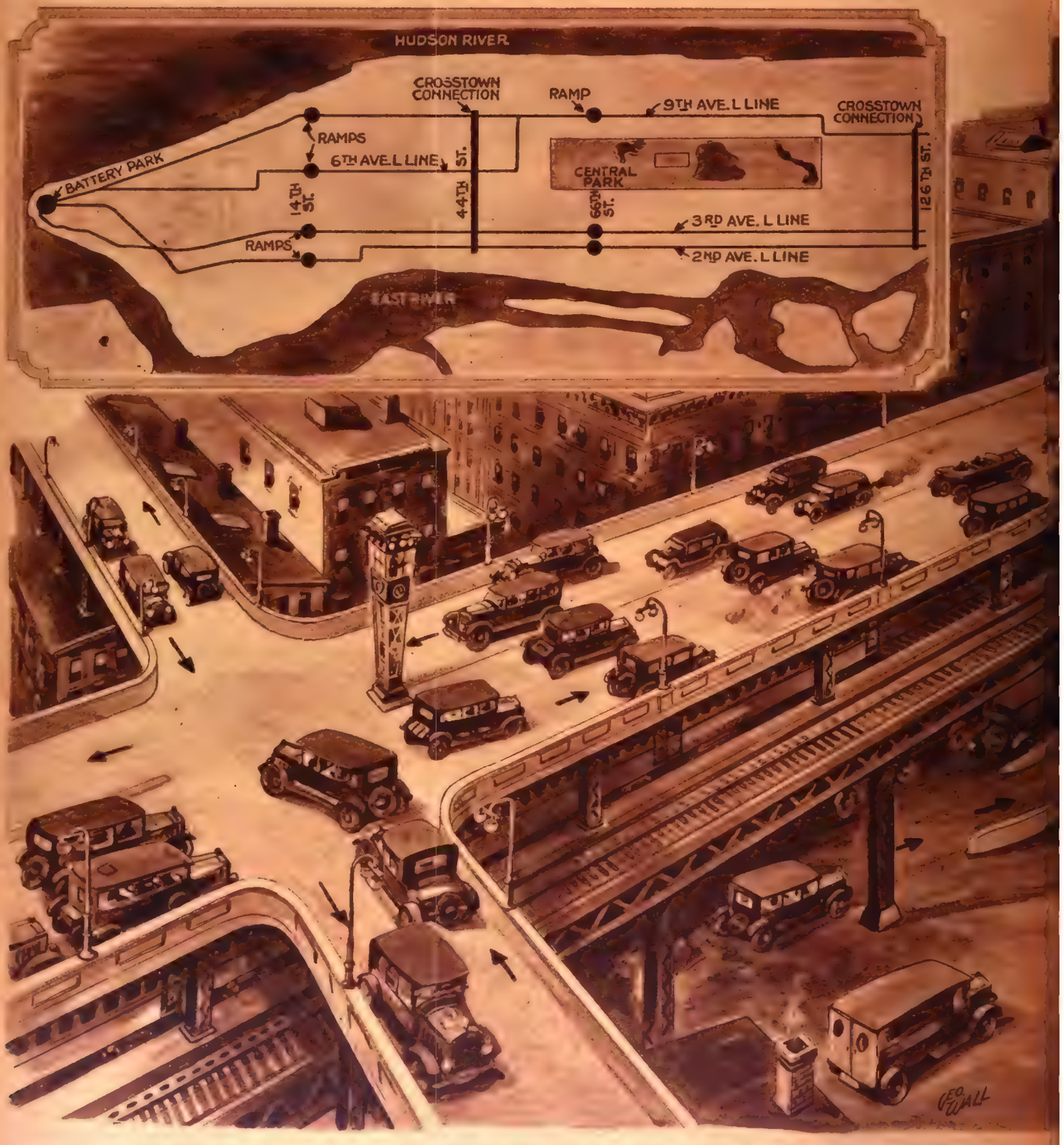
The steel tank, as the drawing shows, will be about 1½ ft. in diameter and 7 ft. high, while the steel walls will be about ¼ of an inch thick in order to withstand the terrific water pressure at great depths. The pressure of the water increases approximately one-half pound for every foot one descends. The exploring tank will have a thick glass window 7 by 12 inches in size and capable of withstanding a pressure of several tons to the square inch. Dr. Beebe expects to begin experimenting with his new deep sea tank next spring, after he returns from Haiti.

Scene showing self-luminous fish inhabiting ocean's depths and details of man-size exploring tank.

Solving Metropolitan

By HUGO

Member of American



Herewith is shown the project of putting 50 per cent. of New York's automobiles on top of the elevated structures by constructing an automobile speedway on top of the existing four elevated structures. The view above shows the crosstown connection which connects the four elevated sections somewhere near 44th Street, as shown in the map. The author explains how to raise the funds for such a proposition.

THE student of traffic, particularly as it pertains to our large cities, must become impressed with the fact that if congestion gets much worse than it is at present, the very vehicles that are supposed to transport us and our freight rapidly will become obsolete, due to their staggering numbers. In our big cities this congestion has become so terrific that if you want to get anywhere within the concentrated traffic areas you can get there much more quickly on foot than by using any surface vehicle. Evidently the evil is progressing rather than abating, and what the conditions will be five years hence becomes one of the most interesting speculative topics of the day. It is reported that in Paris at the present time experiments are being made to park standing automobiles under the street by having an inclined ramp at certain corners, where automobiles can dive in and stand there out of the way. How many can thus be stored comfortably is not known.

The idea of double-decking streets is, of course, not new, having been suggested by many writers. It already has had a tryout

Traffic Congestion

GERNSBACK
Physical Society

The above shows the system of ramps, or approaches extending for almost two blocks parallelling the structure and curving underneath the elevated railroad to the street, to facilitate the automobile traffic, either coming or going, to the elevated speedway. The insert below shows cross section of the speedway, showing that four rows of automobiles can be accommodated. The other view shows the motor roadway looking from top.

recently in Chicago, where one such street is already in use.

The counterpart of the traffic congestion that exists in the City of New York probably cannot be found anywhere else on earth. This city, due to its geographical configuration, centers all the traffic within a comparatively small area. There are more vehicles passing a given point in the congested part of New York than any other traffic center on the face of the globe, and only those who have seen the terrific amount of congestion there have any idea of what is really going on.

It is, for instance, an everyday occurrence that at theatre time it will take some twenty or thirty minutes for an automobile to go the short distance of three blocks. The same distance can be covered on foot in less than two minutes, and most people, when they are late, always leave their cars and travel on foot, weather permitting.

New York City, however, offers a sort of solution for this evil, and the proposal which I make herewith seems to provide relief for at least fifty per cent of the auto-

(*Continued on page* 1057)

Into the Fourth Dimension

SEVENTH INSTALLMENT

First American and Canadian Serial Rights

By RAY CUMMINGS

"Will saw but dimly. Saw shapes floating in there. Dismembered shapes. Others, whole, floating inert. A caldron with bubbles of sight and sound and smell."

CHAPTER XIII

THE REALM OF DEATH

I MUST tell again of that moment when we—Bee and I—were standing beside the lolos field with Brutar and Eo. Brutar had turned away. Eo—prompted, I had no doubt, by Bee—murmured, "This is evil! We will escape—"

My arm reached for Bee. I told myself intensely that now we must escape . . . now I must fling my thoughts—my mind—out into the void. . . . And stay with Eo; he would lead us. . . .

I think my groping hand never reached Bee. I felt a swishing sound. A swirl of thoughts struck me—like feathers blown against me in a gale. But they seemed to cling. Invisible, imponderable—barely palpable; dimly I could feel these thoughts like a net entangling me.

I was floundering. Surging through blackness. Where was Bee? I thought I saw her and Eo whirling near me. But it was a thought unreal—hallucination; for as I tried to grip it and make them visible, they were gone. My thought of them dissolved into a realization that I did not see them, for they were vanished.

But Brutar I saw; a distorted wraith of him . . . his grim menacing face . . . grim with combat. . .

I was rushing through blackness. But as an undertow may suck the strongest swimmer, something was pulling me back . . . a hampering net around me . . . materializing into greater ponderability . . . holding me firmly. . . . The blackness about me was taking form. I strove to think I saw the Big-City. Told myself that that hovering shape above me was Thone—the friendly Thone; not Brutar.

But it was not Thone; and this place that was clarifying to my vision was not the Big-City. The lolos field! I came—was dragged, sucked back to it! The lolos field—I was standing there where before I had been. And the menacing shape was Brutar—my captor standing there grimly confronting me.

But Bee and Eo were gone.

These two escaping, came upon Thone, Will and Ahla as I have related. Came upon them hovering nowhere in the void. Eo was stricken. Brutar, with what quickness and evil power of mind I could not conceive, had struck at Eo. A wound, a derangement not physical, but mental. His mind now—sick, stricken with disease. Almost wandering; yet not quite unhinged—for the power of his will was holding it. Bravely he clung to sanity. Fought for it. Yet those—his friends with him—knew then that he fought a losing battle.

They hung there in the void. Bee was sobbing, "I don't want him to die! He is my friend."

He held tightly to her. His eyes were very wistful. "They call you a girl—and now I know I love you!"

The void was moving. It seemed so to Will; seemed that the blackness was moving past them. Or was it that they—the little knot of their hovering shapes—was moving? Then Will realized that it was Eo—his stricken, wandering mind—dragging them somewhere. The void seemed moving—for how long Will did not know. And then, far away, in Space and in eons of Time, something became visible. A faint star-dust glow. A luminous patch. It broadened; spread to the sides, and up and down until everywhere before them lay its gleaming radiance.

The realm of disease! Will heard Ahla murmur it in accents of sorrow and apprehension. Eo was rushing for it—and no power that they had could stop him.

The radiance intensified. A fear—a shuddering horror possessed Will. With every instinct within him, he recoiled from the approach. Revolted. But he held tightly to Thone and to Bee; told himself that they would lead him safely.

Everything was glowing; they were wholly within the glow now. A silvery glow that shone everywhere about them. But soon to the silver there came a greenish caste. It deepened. A green, with its sickly look of death. Green, with the silver turning to a pallid, flat, dead whiteness. And then a mingled brown; a murk, like a fog pervading everything.

Abruptly Will became conscious that Eo was no longer with them. His last despairing cry; and Bee's echo. He was going—floating downward; while they, uncontaminated, hovered above, at the edge of the realm, to see it but not to enter.

Will saw but dimly. Saw shapes floating in

Synopsis

Robert Manse, a correspondent in the New York Office of a Latin-American export house, in company with Wilton Grant and his sister Beatrice, saw the first of the ghosts in February, 1946, a few miles from Rutland, Vermont. These ghosts were semi-transparent, glowing figures much resembling human beings. Attempts to destroy them with bullets or clubs had no effect on the shadows.

Some time later, Will calls Rob on the telephone, saying that his sister Bee is quite ill and asking Rob to pay them a visit. During the visit Will mentions that the ghosts have already arrived in the Borderland lying between their world and ours, and that they were on the point of coming into our world. Will himself has discovered a means of entering into this borderland, and declares that even though he is being watched by many of the ghosts he will make an attempt to enter their realm and turn the spirit-like creatures back into their former paths. While he makes the journey, Rob is to stay behind with Will's sister, Beatrice.

The preparations for the experiment are made, and Will clasps upon his arm a connection to the vibration-transformer which, by altering the vibrations of his body, is to transform it from normal substance to the wraith-like material of the other world. They see a ghostly form watching them as Will's body becomes transparent. Finally the apparatus is disconnected and they wait for his return. Five hours later, Will returns saying that they must go back with him to save the world from an invasion of the ghostly hordes.

Robert and Beatrice, though face-to-face with the unknown, succeed in suppressing their fear, and agree to accompany Will across the border. The three adventurers don their metallic garments, attach the batteries, and swallow the acrid compound which is to transform their tissues. In a few minutes they find themselves transposed into the Borderland.

They meet Ahla who takes them to the big city. The triplet is told that Brutar is inducing his followers to enter our world. A battle of thoughts takes place among the ghosts. Brutar captures Rob and Bee with thought waves, and tells them that he can use them for his conquest of the earth. Will and Ahla go to the rescue.

Brutar brings a young man, Eo, on the scene and they both listen to descriptions concerning earthly life. Brutar shows how material things are made from thought waves. He also shows Rob and Bee the lolos plant which has a conscious mind. The blood from this plant enables the ghosts to enter our realm. During the demonstration Bee and Eo escape.

Now continue with the story.

there. Dismembered shapes. Others, whole, floating inert. A caldron, with bubbles of sight and sound, and smell. Shrouded in murk. Unreal. . . . A wailing . . . sobbing . . . faint aerial voices wailing like ghosts distraught. . . . And a stench—the thought of it, no more . . . but to Will the thought, the knowledge of all this was horrible, fearsome. Singularly fearsome; above everything at that moment he feared this realm, this state of unnatural, tortured existence. . . .

They could still talk to Eo. See him there, laboring, losing his brave fight to come back to them. He seemed very far away; and yet very close, for though his form was down there, engulfed with all the leprous horrors of disease, his voice was very plainly heard. And his face, the image of it, the physical representation of it to Will's thought, seemed again at hand. His eyes were very wistful. He was smiling gently at Bee.

"Soon, girl, I will be gone—into death—it is very near now. I can see it—see it, just ahead . . ."

Will saw it, too. Another realm beyond the one they were skirting. The realm of death. It lay close ahead. Dark. Mysterious. Scarce to be seen, but only imagined.

Again came Eo's faint voice. "I shall—be there in a moment. It is very—beautiful. I can see it—right here—" And then he suddenly whispered, "I love you, my girl Bee—"

And vanished.

Or did he vanish? The shell of him then seemed lying in Bee's arms. But it was an empty nothing; the shell of a shape of something which once had been, but now was not. . . . Bee, with an abrupt revulsion, drew away from it.

Thone said gravely, "Watch it, Will. The Divine thought is gone from it. Our own thought-matter is all that is left. You shall see of what permanence that is."

The dead shell lay inert. It was dissolving; . . . Grewsome. . . . Will turned away; then forced his vision back to see a leprous wraith—a rotting shape which presently, like a melting fog, began to dissipate. Dissolving, until the very last essence of it was gone into nothingness.

Ahla seemed to sigh. "It is very horrible. Yet I think that we are wrong to consider it so, for it is Nature."

Will recovered himself. The realm of disease had withdrawn to a memory. Around him the blackness seemed purified. But ahead he could see—or thought he saw—that other endless realm where dwell what we call the dead. Questions flooded him. Eo was there? Could they not go and see him? Could he—this Entity which once had been Eo—could he not still speak to them from beyond the borders of death?

Thone said, "We will approach it if you wish."

Unnamable time; and then Will found that they were there, hovering; and a realm, a place—a something he knew not what—lay spread above them. Earnestly he groped for it. Not with his physical hands; but with his senses. His thought went there and back. He thought he saw shapes up there. Hovering, glowing shapes in

"a place lay spread above them. Earnestly he groped for it. Not with his physical hands; but with his senses. He thought he saw shapes up there."

a great light space. And with futile, childish imagination he endowed them with beautiful, ethereal qualities; transfigured them into glowing human shapes of beauty and peace. And thought he saw them; and that they might speak to him. Or that perhaps, because Thone might be more than human, they might communicate with Thone, and thence to him.

"The encampment was deserted! Abandoned! The lolos field was disrupted; its plants gone. . . . disintegration already was taking place. Holes of nothingness were visibly eating their way into everything."

And then he laughed. It was all so childish! But his laugh turned grim, for he knew at once that this futile desire to penetrate that which the Creator has shrouded in mystery was more than childish. . . . Infamous. . . .

Thone said, "Eo is there, in the darkness and the light. You can think of him. Your thought will go there. And it will come back to you, fraught with what qualities your imagination may lend it. But nothing else."

"No," said Will, "nothing else. I understand that now. It is good that it is so."

"Good, indeed!" Ahla echoed. "We can probe too many mysteries for our own welfare. From whence and why we come—and where we go—we assume Divinity to seek these answers."

Will asked, "There are some in your world who think they can penetrate the veil of death?"

"Yes," said Thone. "There are some."

CHAPTER XIV

THE BIRTH OF A THOUGHT

THEY turned away in the void—away from the dark-light mystery of the realm of death, and drove themselves back to the Big-City. The search for Brutar's encampment was at the moment futile; they knew they could not reach it. And though Bee had escaped with Eo, she did not know whether I escaped or not.

They hoped to find me safely returned to the Big-City. But I was not there. But still Thone felt that I might come. To Will—with his inherent, instinctive conception

(*Continued on page* 1042)

"As I had completed the writing, the medium asked for the slate, and read, out aloud what had been written on it."

Our Spiritualistic Investigations

NO. 8 OF A SERIES

By Dunninger.

BELIEVERS in spiritual phenomena, particularly those who believe that they receive messages from the dead, either upon the surface of examined slates, or in the various forms of message-producing methods, employed by different "ghost controllers," lend themselves as an essential part to the wide and valuable advertising of the medium's name and talent. It is a fact that they are always requested to write down a question, referring to the information they desire from the spirit world, rather than a mere statement or a single word. Either could be read as well as the question, but the reading of neither would be as impressive as that of the question in general. For reasons not obvious to the average spectator, when a spirit worker reveals what has been written as an apparently concealed inquiry, the spiritualist gains at least a part of the glory that would have been attained, had he answered the query. This is the reason why the medium so often requests that the sitter write an invitation to their favorite ghost, before the spirit fingers can be made to answer. As to whether or not real spiritualistic messages are possible, that is a problem not unanimously decided upon. Certain investigators, who are worthy of respect, have convinced themselves of the possibility, but have not succeeded in causing their belief to be shared by anything like a majority of the psychologists, who also are scientists, with an admitted knowledge of evidential values. Mediums have various methods of obtaining information, other than calling upon their spiritual secretaries, from out the heavens of unknown spheres. They differ greatly from one another in their forms of procedure. One thing is sure, however . . . it is not by the exercise of any mysterious power, or sixth sense that they operate, and the explanations of these methods, when forthcoming, are as absurdly simple as the explanations of such "miracles" always are.

One of the foremost producers of messages, and perhaps one of the cleverest "readers" (a term used among bogus mediums), was Madame Lowe, a spiritualist in San Francisco. A tremendous business was established by Madame Lowe, who had no limited office hours, and boasted of a steady flow of customers daily. From 9 A. M. until midnight, came the callers. So numerous was her clientèle that she was looked upon with envy, by many of the neighboring fraudulent spiritualists, who were engaged in a similar line of business. She had been established at her residence on Mission Street, for quite a number of years, and was accepted by her many neighbors as a rather prosperous person. The medium occupied the entire building. Her waiting room consisted of what seemed to be originally two rooms, with the dividing wall taken out. At the time of the writer's visit to the medium's den of enchantment, this waiting room was well crowded. This probably accounted for the extra spacious sitting room. It was fully an hour that I waited, until I was finally ushered into the room by a short, stubby, elderly gentleman, in whose fine facial features, a studious expression predominated. He had all the semblance of a college professor, and in deep low tones I was introduced. I did not regret my long wait, however, as there was quite a lesson to be learned from the faces of the waiting visitors. A high amount of respect seemed to be maintained for the medium, as their conversation was carried on only in whispers, as if in fear to speak aloud. My inquisitive attitude got the better of me, induced perhaps by their whispering, and as time hung heavily upon my hands, I strained an ear to listen. I caught a sentence here

(*Continued on page* 1055)

$21,000.00 for Spirits

Dunninger, who writes exclusively for SCIENCE AND INVENTION Magazine and who is the Chairman of our PSYCHICAL INVESTIGATION Committee will personally pay $10,000.00 to any medium or spiritualist who can present any psychical manifestation in so-called spiritualism, that he will not explain or that he cannot reproduce by natural means.

More than two years ago SCIENCE AND INVENTION Magazine offered a prize of $11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of a psychical demonstration which in itself was not trickery.

The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.

In view of these facts, should we not consider all mediums fraudulent?

To the $10,000.00 which has been offered by Joseph F. Rinn through this publication for Spiritual proofs and the $1,000.00 in addition offered by SCIENCE AND INVENTION Magazine we now add Dunninger's $10,000.00.

So now we have a total of $21,000.00 offered for proofs of Psychical Manifestations. Spiritualists—get busy.

Monthly Matchcraft Prize Contest

This Is a Continuation of the Famous Matchcraft Contest Which Has Just Completed Its First Year. This Department Will Continue to Award $100.00 in Prizes Monthly for the Five Best Matchcraft Models Submitted During the Month

First Prize—$50.00 has been awarded in this month's revised Matchcraft contest to Fred Spinden of Abingdon, Ill., for the frying pan illustrated in the photograph above and to the right at the top of this page. Observe how each and every match in its construction has been bent to produce the curved bottom and sides of the completed article. Photograph posed by Miss Sadie Bernstein gives us an idea of the size of the model.

Frying Pan Wins First Prize—$50.00. Article made by Fred Spinden, Abingdon, Ill. Coal tipple by C. W. Reese, Zanesville, Ohio, wins second prize—$20.00.

Second Prize—$20.00 was awarded in the contest to C. W. Reese, of Zanesville, Ohio. Mr. Reese carefully reproduced those most important features found in coal tipples. Note the two railway tracks in the foreground, one for the small push car and the other for the larger freight cars. The entire article is mounted on a wooden baseboard which of course does not constitute a portion thereof.

Fourth Prize—$10.00 is awarded to Warren C. Brown, of Ossining, N. Y., for the model vessel illustrated in the photograph. This vessel is approximately 14 inches long and the sides thereof are built on regular ship ribs. The only portion which is not made of matches are the ropes and sails and of course the Le Page's glue used to bind the matches together. The sails themselves in this particular construction are made of heavy paper curled to maintain this shape.

Third Prize—$10.00. The airplane illustrated in the photo above was made by Alfred Roman, of Bronx, N. Y. It is a scale model of the Curtiss J. N. 4-D-2 training plane 1/14 full size. Over 7,000 matches were used in its construction. The plane is of course provided with the proper rudders for steering and elevating and is likewise fitted with demountable wings. It is cross-braced with thin wires which do not show in this particular photograph. The model itself was very well finished and was then gilded. With this construction Mr. Roman wins the third prize. It is suggested that other matchcrafters continue their work on models of this nature and enter them in turn for the prizes inasmuch as this contest will continue until further notice with the present revised schedule of prizes.

Fifth Prize—$5.00 was won in this contest by J. J. Bush, of Trenton, N. J., who should certainly know what the city hall should look like, inasmuch as he lives there. This model was approximately 30 inches long and many thousand matches entered its construction. Note that the name Trenton appears on the front of the building. Cut matches were employed to produce this effect.

Now turn to the rules governing the Matchcraft Contest. They will be found on page 1071.

Is the Earth Slowing Down?

By Dr. DONALD H. MENZEL

Lick Observatory, Mt. Hamilton, Calif.

Fig. 1 above shows how the position of the moon varies from the mathematically predicted spot in the sky and the reason why this variation takes place and fools astronomers at times is explained in the accompanying article by Prof. Menzel.

This diagram serves to show how an observer may see the moon higher in the sky than his calculations would have him expect, due to variations in the earth's speed, which is in turn caused by changes in the earth's diameter.

RECENT investigations show that the rate of the earth's rotation is not constant but variable. Since the time of Newton, one of the tasks of astronomers has been to calculate the orbits of the heavenly bodies and predict their positions for the future. The problem has not been a simple one. If the earth were the only planet, few difficulties would be involved in computing its motion, but the presence of Mercury, Mars, Jupiter, and the other planets complicates matters. Each of these exerts a force upon the other, piling disturbance upon disturbance over the simple motions until only the most intricate mathematics can untangle the effects and predict the future.

Fig. 3 above shows how the earth may expand at times and cause its rotational speed to change, which would cause an observer of the moon to make a mistake as to its position.

Of all the heavenly bodies, the most erratic is the moon. In the first place, it is the nearest to the earth, so that small discrepancies in its motion are more easily detected than for the distant objects. Professor E. W. Brown, of Yale, has carried out more computations for the moon than any other one person. It is his lunar theory and his tables that are used by the computers of the Naval Observatory to predict the position of the moon, eclipses, etc., for the Nautical Almanac. The curious thing that has gradually become apparent is that, after allowing for every conceivable disturbance, the moon still fails to keep to the predicted place; sometimes it is ahead, sometimes behind. (See Fig. 1; also Fig. 2.)

The discrepancies in the lunar motion were most noticeable at times of total eclipses of the sun. It is rather annoying, too, as well as inconvenient for the astronomers not to know the exact second that the moon will completely cover the solar disk. They are making observations under a schedule that makes every second count and delays or surprises may be costly.

A notable characteristic of the small variations in the moon's motion is that over long periods of time, they cancel out. This fact led Professor Brown to look within the earth for the cause of the lunar inequalities. Additional incriminating evidence against the earth came from the observation that when the moon was ahead, so, also, was the sun, etc., until recently, Professor Brown feels that he has clinched the argument.

Fig. 4 shows man swinging a stone tied to a string. If he shortens the string by grasping it at the point A, the revolution time of the stone will be shortened. The same thing is true for the earth.

He has shown that if the earth alternately expands and contracts (see Fig. 3) the rotation will vary greatly. Why, is illustrated in Fig. 4. If the earth expands uniformly throughout, an increase in diameter of only ten inches is required to account for the lunar discrepancies. If, however, the earth does not expand as a whole, perhaps only the top eighty miles or so participating in the swelling, the diametrical increase would have to be 24 feet.

An increase of one foot in the diameter of the earth will lengthen the day by about 8 thousandths of a second. While this may seem very small, in several years it would amount to considerable. How such a slowing down would affect the observations of the moon is illustrated in Fig. 5.

Another way of looking at the result is as follows: If the earth is slowing down we will not be conscious of it ourselves. However, since we set our observatory clocks by observations of the stars, it is obvious that they are slow compared with a clock set by a uniformly rotating earth. When we make an observation of the moon by the observatory clock, the moon would be higher in the sky since the clock is slow.

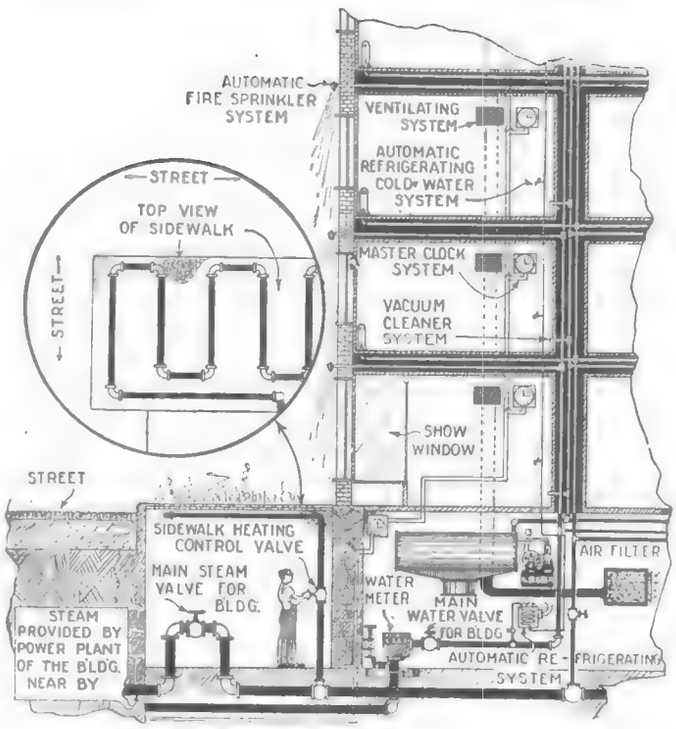
Professor Brown very wisely hesitates to comment upon the possible causes for such a pulsation of the earth. The problem is one for the geologists rather than the astronomers. Undoubtedly, radioactivity will be mentioned. Radium, thorium, and other similar substances are constantly disintegrating into other elements with the liberation of heat. It may be that the accumulation of energy finally causes an expansion until the heat is gone. Then contraction will follow and the process will be subsequently repeated. One wonders whether there may not be some connection between the upheavals and earthquakes.

This variation of the earth's rotation causes the errors in the position of the moon. For example, hitherto, the astronomer has regarded the rotation as uniform. He makes an observation of the moon, thinking himself to be at A. Suppose, however, that, during the year the earth has been expanding and rotating more slowly than he supposed. The astronomer would, then, actually be at B and observe the moon higher in the sky than he predicted, see Fig. 2. The moon is in its true place. The discrepancy is due to variation of the earth's rotation.

Sowing from the Skies

A dispatch from Winnipeg, Manitoba, announces that the Manitoba Department of Agriculture has decided upon the adoption of a new method of sowing rice in the great marshes of that region. A number of sacks of wild rice have been forwarded to the Lake Cormorant station on the Hudson Bay Railway for distribution by airplane over suitable marshes in the northland. It was found that no wild rice grew north of latitude 53°, attributed to the fact that ducks are coming south during the rice season. Prof. V. W. Jackson of the Manitoba Agricultural College suggested that some of the land be seeded, and an airplane was dispatched to distribute the rice from the air. This experiment is expected to result in a widespread use of the airplane in agriculture.

Modern Building Equipment



A new office building in Rochester, N. Y., is equipped with a number of novel mechanisms. Between every floor and ceiling is a space three feet high containing telephone wires, plumbing, etc. Electric clocks, air filters, drinking water refrigerators, and a sidewalk heated to prevent the formation of ice, are some of the features.

The Astrology Humbug

By JOSEPH H. KRAUS

Further Letters From Our Readers and Our Answers

Editor, SCIENCE AND INVENTION:

Though my present line of business does not permit me to investigate all manner of psychic things, I cannot help but wish that I had such an opportunity, for there is a fascination in such things that pleases me, but I fear I am too practical to swallow wholly everything that is told me, yet the idea is in my mind to want to be more decided, not upon what I see, as to discover whether we make our own conditions in life or whether we are doomed to a destiny, through the necessity of needing to go through certain earth experiences.

Astrological predictions never did worry me, and a couple of years ago I was told that at a certain time, which has since passed, that I, myself, would either die or a very good friend would die; fortunately for me, an old aunt of mine who has wanted to die for a number of years and couldn't, did at last pass away, and my friends were saved the necessity of weeping at my funeral. I did have one unpleasant experience with this particular so-called astrologer, in that I loaned him some money (why, I don't know) but got it all back after threatening him with the District Attorney's office, and 225 pounds of a somewhat pleasing countenance behind my argument.

According to my chart you should never publish this enclosed article, for my progressed moon is forming an aspect, opposition to the writer's planet Mercury, which in the radical horoscope is a semi-square to Saturn in the ninth house in my chart, conjunction with my ruling planet Venus (which, by the way, causes me to be a H—L of a guy) and the progressed Venus is also forming an opposition to the progressed moon, and the progressed moon in the progressed horoscope is in opposition of the mid-heaven, so if you do happen to publish this article I have written, we will have to look further into the matter of the horoscope to see just why you did, which may require me to investigate the prenatal horoscope, a condition I have not done to date.

(Mr. Hatton then continues with an article on Astrology, telling us why he believes in the subject and also which portions thereof he does not believe. A part of this article follows here.—Editor.)

To my way of thinking, SCIENCE AND INVENTION Magazine is assisting in bringing to a conclusion the facts in the case, by making more prominent the truth of conditions as they now exist in Astrology, and it seems to me, that those astrologers who seek the truth rather than the piffle, and who are inclined to want more exact knowledge along this line, should welcome the opportunity for discussion, and those who are prominent in the astrological world, should make every endeavor to prove that this magazine does not know what it is talking about; if I could I would, and if I see a chart of a person who is about to have the progressed sun pass over his Jupiter, I'd certainly predict a fortunate year for him, or if I saw a progressed Jupiter transmitting his radical sun, I'd predict a number of good years for him, but I couldn't tell him why except that it was in the books, and the why of things is what counts, and until there are definite laws in Astrology which can be proven beyond any reasonable doubt to be fixed laws, such as the prenatal epoch and the law of sex, Astrology should be made plain to those people who are interested in it, and who want a horoscope, that it is not an exact science in this sense, that your predictions are absolutely correct, but that it is a science based upon observation and correlation, fitting planetary conditions to events that could happen, and not to events that will happen; that events do happen in cases, does not necessarily mean that the same event will happen to all such cases, and this alone proves that Astrology is not an exact science. There may be something to the idea that a person with Saturn strong in the horoscope shows certain definite characteristics pertaining to this planet, or that Mars imprints upon a person other characterstics, recognizable to the student of Astrology, and in this respect, these conditions can be classified and analyzed; it may be possible to predict in a limited manner, such events as radical transits and suggest times of events of the character of the transit, but not until definite laws governing the elements can be formulated, can we call Astrology an exact science; I believe that this is possible of accomplishment, and we are working towards this in the finding of the death ray, and the Proton-Neutron so ably described in SCIENCE AND INVENTION Magazine for December; and Astrology perhaps goes beyond the fact, and out of this condition will come laws of which we can judge correctly.

Astrologically yours,
RAYMOND HATTON.
Oklahoma City, Okla.

(According to your chart, you mentioned that we

(Continued on page 1069)

$6,000.00
For Proofs of Astrology

SCIENCE AND INVENTION Magazine holds that there is nothing scientific in Astrology, that Astrology is not a science and that statements made by astrologers unless very general cannot be entertained seriously.

Accordingly, this publication has decided to award an Astrology Prize of $6,000 for the following:

$5,000 will be paid to the astrologer or forecaster who will foretell three major events of such a nature that he will have no control over the outcome of the same. He must describe in advance each event in detail, giving the location and result or the casualties if the event is an accident.

$1,000 will be paid to the astrologer or forecaster who will produce three accurate, detailed and perfect horoscopes, free of contradictions on the lives of three people whose initials will be given him when he requests the same and the birth dates and place of birth will also be supplied by this office.

This contest closes October 1st, 1927, and all entries must reach us by that time. In event of a tie, prizes of an identical nature will be given those so tying.

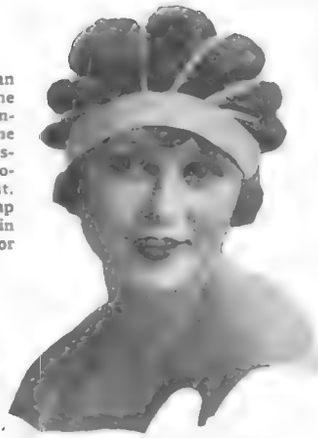
Address all entries to Editor, Astrology, care of SCIENCE AND INVENTION Magazine, 53 Park Place, New York, N. Y.

Science Makes Women More Beautiful

$30,000,000 Spent by U. S. Women Daily in Quest of Beauty

By RHYS G. THACKWELL

From time immemorial, women have tried to make themselves look more beautiful and attractive. More than 3000 B. C., vanity cases were used as excavations show. The reports have it that the woman of the United States spend three times as much money to beautify themselves as they do for bread.



At the left is an example of the head-dress obtained when using the curling cap illustrated in the photo at the right. The curling cap can be worn in the morning or while asleep.

The cap above produces a water wave and this can be done in a few minutes without any skill and with a saving of much time. Its wearer can dress while the cap is in place.

At the right we have a unique hair testing machine which enables its operator to tell how well the hair will stand a wave.

The Department of Commerce of the United States claims that women of this country spend $30,000,000 daily in making themselves more beautiful. There are more than 25,000 beauty shops and much of the money goes into home treating devices and cosmetics.

The article shown above is a hair tester which reveals the nature of the hair and eliminates the guess work in overcurling or undercurling. It will tell the girls if their permanent wave will last.

The article shown in the above photograph is a combination marceller and curler, either portion of which is interchangeable. It is claimed that oil used after the shampoo is absorbed and does not show on the hair or scalp.

Lipsticks now come in a new form, namely they resemble safety matches and may be used once and then thrown away or the match may be reinserted into the packet for subsequent use. The pointed tips enable fine definition and the colors and flavors are numerous enough to satisfy the most fastidious.

In the photograph above we find a combination comb which forces shampoo through the teeth of the comb, enabling it to be worked down into the scalp and then afterward washes the hair with water, the water being also forced through the comb teeth. Below a marcel waver for curly heads whose hair should never be touched with irons or curlers. No skill is required.

The device illustrated in the photograph below is for the purpose of assisting in the development of the chest.

An indication may be obtained from the tape as to the amount of actual chest expansion. Exercising will increase the reading.

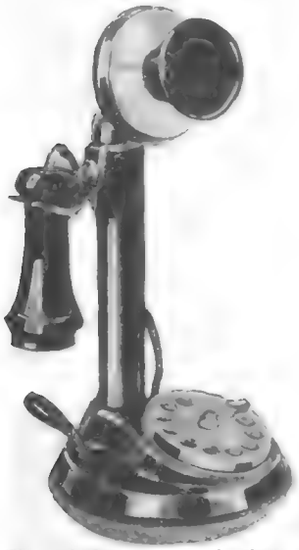
For those who desire that healthy outdoor complexion and that perpetual tan, H. Gernsback suggests the method illustrated above. It is merely an electric radiant heater, but it will produce its effect quite as well as the far more expensive ultra-violet ray lamps.

(Names and addresses of makers of above devices furnished on request.)

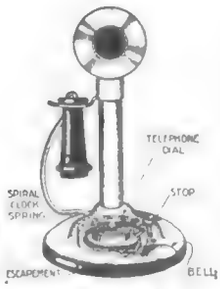
Science in Toyland

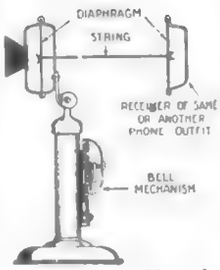
Descriptions of the Latest Toys Which Will Interest Purchasers This Year

TOY manufacturers are constantly forced to work under pressure to produce novelties which will appeal to the critical taste of the juvenile mind. It is no easy matter to create entirely new toys and to design and produce them in such form that they are substantial enough to withstand the rough usage received at the hands of most youngsters. A few of the latest products of some of the larger manufacturing organizations are illustrated on this page. Their selection was based on merit.

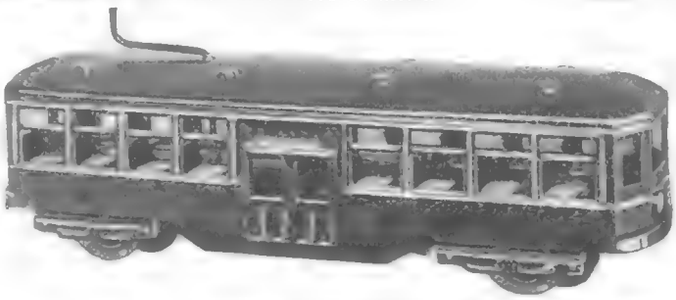


The telephone above is just the thing to delight the child who insists on having the very latest thing in toys to amuse himself. The telephone dial, when operated as if to call a certain number, rings a bell concealed in the base of the instrument. The action is controlled by coil spring.

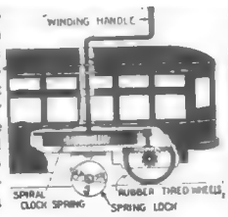




Here is a toy telephone (constructed on a principle known to all boy mechanics), which actually works. The voice vibrations are transmitted along a string or wire attached to the diaphragm of the transmitter, and by this means they may be carried considerably further than the voice alone will go. Two strings are required to complete the circuit for two stations. They must be strung so as to be free to vibrate in transmitting the sound. The bell on the back of the instrument rings when receiver is raised.

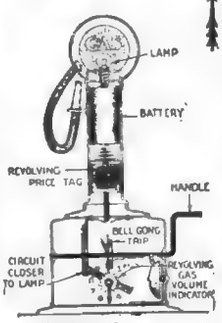


One of the best-looking toy cars which we have tested is shown in the above photograph. It is a street car made from heavy metal stampings. The wheels are equipped with rubber tires, so the device is practically noiseless when in use.

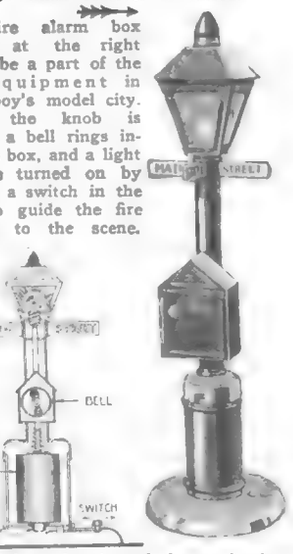


At the left, the constructional features of the street car. An offset on one of the axles operates a bell which rings realistically as the toy rolls along. The front wheels are adjustable for straightaway or circular runs.

At the left, a gasoline filling station in miniature form which works very much like the real thing. Of course it will not pump gasoline, but a bell rings for each "gallon" and a light flashes realistically in the housing at the top. The device is made out of sheet metal.



The drawing at the right shows constructional details of the gasoline pump in the photograph above. The shaft attached to the outside handle carries most of the operating mechanism for the bell and lights, and it also indicates the amount "pumped" on a small dial.



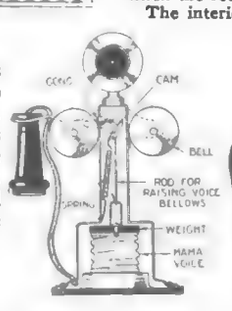
The fire alarm box shown at the right should be a part of the civic equipment in every boy's model city. When the knob is turned, a bell rings inside the box, and a light may be turned on by turning a switch in the base to guide the fire engines to the scene.

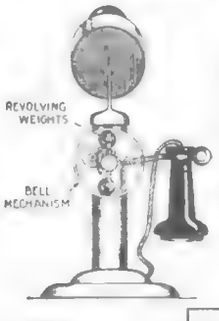
Above at left, a drawing of the mechanism contained in the fire alarm box. The battery used is of the type sold for installation in flashlights. The bulb is also standard flashlight equipment.

Pipe Contest

In the next issue of SCIENCE AND INVENTION Magazine, the awards in the Pipe Contest will be announced. Thousands of entries have been received in this conest and at the time this magazine goes to press the judges are busy in sorting out the prize-winning suggestions.

Another of the toy telephones is illustrated below. This particular instrument is adjusted so that it says "hello" or "mama" when the receiver is removed from the hook. The interior machinery is shown at left.





ALL of the toys illustrated on this page are substantial enough to weather quite a few seasons of bumps. One of their most desirable features is their simplicity. All the parts of the mechanisms are built to wear, and there is no reason why they should get out of adjustment if the toys are not deliberately destroyed.

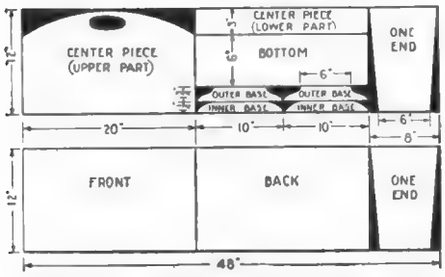
Another of the toy telephones is made so that when the hook is released the bell rings lustily.

Here is a game similar to Quoits, which is adapted for either indoor or outdoor use. The object is to lasso the pegs if possible. Luck and skill both count.

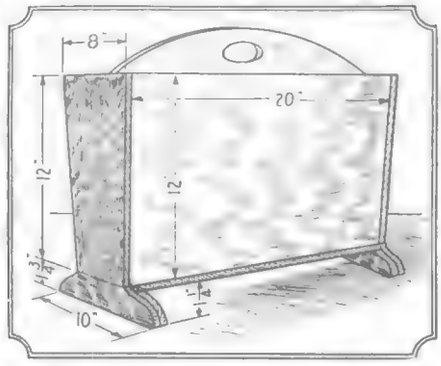
Photos courtesy—game—Nu-Shu Game Co.; car—Kingsbury Manufacturing Co.; all others—Gong Bell Mfg. Co.

Further Board Contest Awards

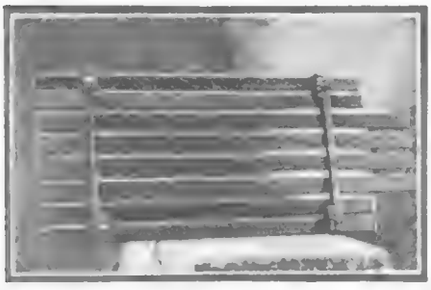
Continuation of the $300.00 Prize List

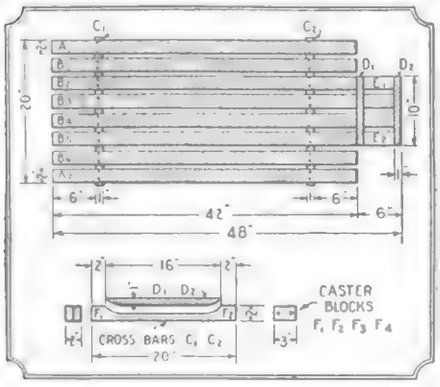


It will be remembered by many of the readers that a Board Contest was announced in a previous issue of SCIENCE AND INVENTION Magazine wherein they were requested to submit articles made from a board measuring 1 inch thick, 4 feet long and 1 foot wide. Prizes on this page conclude the list of awards.



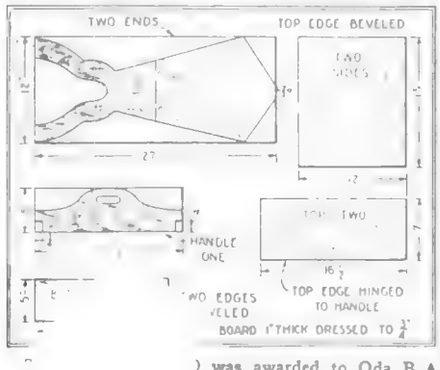
Thirteenth prize—$5.00, was awarded to H. G. Lihou of St. Louis, Mo., for the newspaper rack.





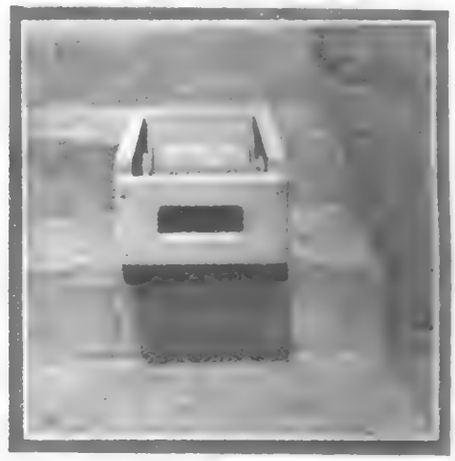
Fifteenth prize—$5.00, to Lemuel G. Leighton, Waterville, Me., for the mechanic's carriage, the dimensions of which are given in the diagram above.

The above photograph shows Mr. Leighton and the mechanic's carriage which he built. This particular carriage is provided with roller casters on its under surface and with it the automobile mechanic can maneuver under any part of the car. Note the practical head rest.

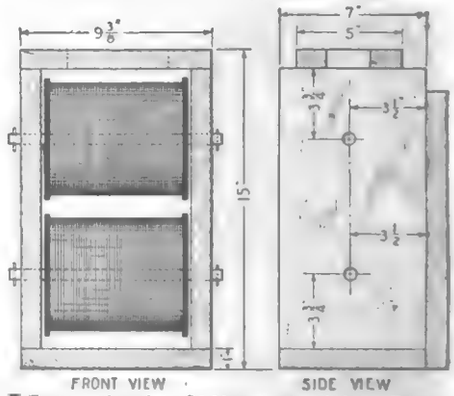


) was awarded to Oda B. ter, Ind., for the sewing the photograph at the left f which are given in the oard 1"x12"x4' is required.

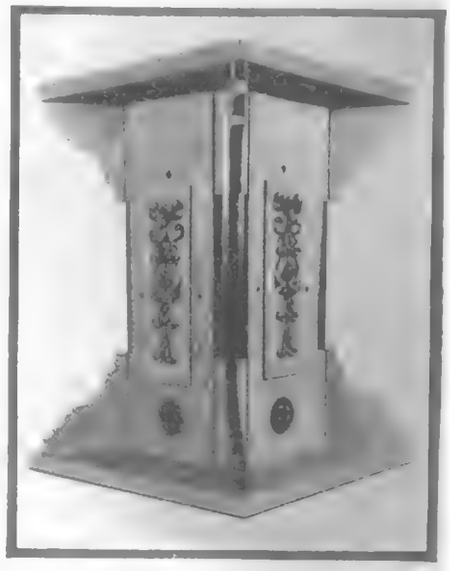
Another view of sewing cabinet.



Sixteenth prize—$5.00 is awarded to William M. Adams of East Stocton, Del., for his wire spool holder. This device is very handy to the radio man who winds his own coils.



Fourteenth prize—$5.00 was awarded to Randolph W. Cormack of San Francisco, Calif., for the King Tut flower pot stand below.

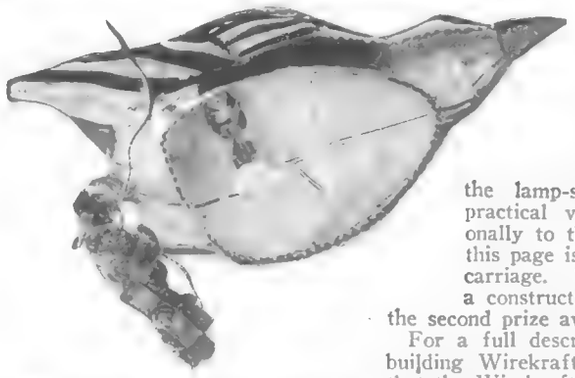


WIREKRAFT—$3,000.00 PRIZE CONTEST

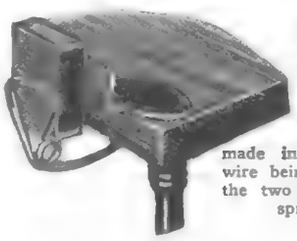
The device here will serve for the boiling of eggs or as a condiment holder.

The photograph at the right shows a remarkable wire bird lamp casting its radiant glow on the book being read by Miss Cleopatra Frager. Another view of the inside of the lamp is shown diagonally below. While the lamp in this photograph is mounted on a pedestal, it is obvious that it can be directly attached to the back of an overstuffed chair.

The photograph at the right shows the interior of the bird lamp which was entered in the Wirekraft Contest by a Wirekrafter anxious for a prize.



ON this page we again show a few more suggestions which have been entered by some Wirekrafters in the new $3,000.00 Wirekraft Contest announced in the December issue of this publication. The first group of awards will officially be announced in the next issue of SCIENCE AND INVENTION Magazine. The Wirekraft Contest will remain in force for a period of one year and each month sixteen prizes will be awarded ranging from the first prize of $100.00 to the sixteenth of $2.00. The first prize in this particular contest will always be awarded for an article possessing utilitarian merit. Any artistic device or a model of a toy could not possibly win the first prize, but it could win the second, which in this particular contest is $50.00 and will be awarded to the best artistic, decorative or constructive effect entered during the month. The remaining prizes from the third down to the sixteenth will be judged from either one or the other angle. Only those parts of the model actually constructed of wire will be judged by those awarding the prizes. Nevertheless, it is quite permissible to use any additional materials for the decoration of the model as for example, the silk on the lamp-shade illustrated in the photograph at the left. While the silk itself does not become part of the Wirekraft model it is obvious to the constructor that the lamp-shade would be of no practical value without it. Diagonally to the left at the bottom of this page is a model of a naval gun carriage. This particular type of a construction could be entered for the second prize award.

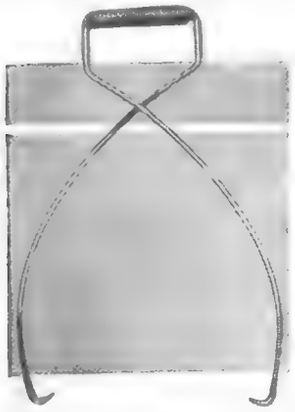


Here is a unique match-box and cigarette case holder which clamps directly to a table-top and which is made in one piece, the wire being bent to form the two holders and the spring clamp.

For a full description of the method of building Wirekraft models, it is suggested that the Wirekrafter write for a reprint of the December issue of this publication referring to the Wirekraft Contest.

Judging by the tremendous number of entries already received in this contest

(*Continued on page* 1064)



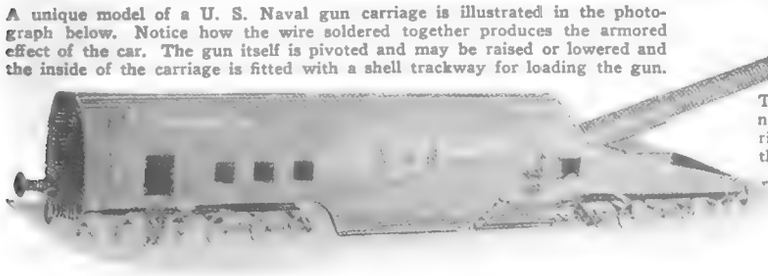
Here is a pair of ice tongs practically constructed. The two jaws are not hinged at the point where they cross. The handle itself is made of wire coiled closely. Lifting the handle causes the jaws to spring together, and holds the ice firmly.

Wirekrafters Note

THE first awards in the Wirekraft Contest will be announced in the April issue. If you have submitted a model made of wire in competition for the awards in this contest you may find your article listed among the fortunate ones in the next issue. If your name is not on the list you will know by comparing it with the other models in what point your construction is inferior to the prize-winning suggestions. You will then still have eleven more months to enter further models.

"Hints to Wirekrafters," a reprint from the December issue will be sent free upon request. Address Editor, Wirekraft, c/o SCIENCE AND INVENTION Magazine, 53 Park Place, New York City.

A unique model of a U. S. Naval gun carriage is illustrated in the photograph below. Notice how the wire soldered together produces the armored effect of the car. The gun itself is pivoted and may be raised or lowered and the inside of the carriage is fitted with a shell trackway for loading the gun.



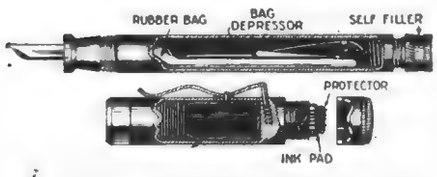
The wheels of the naval gun carriage illustrated at the left turn in groups of sixes on a duplex truck.

Here is a splendid picture frame which has been made by one contestant and in which wire screening is used to produce the effect of a tennis net and to take the place of the gut strings on the racket.

The Month's Latest Devices

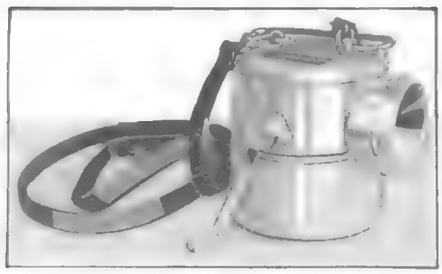
CHECK PROTECTING FOUNTAIN PEN

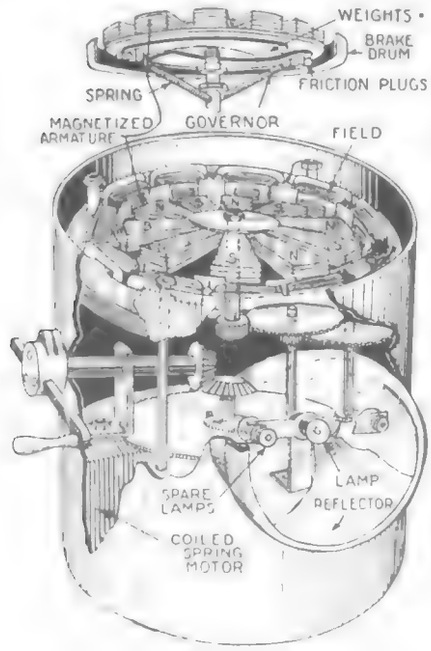
In the photograph above we show a new departure in fountain pens. In this particular construction a seemingly usual type of pen is seen until the top cap is removed. This is a cap at the top of the regular cap and conceals a steel multi-disk check protector which cuts an impression into the check and inks that impression with an indelible ink. The ink pad constantly touches the rollers.



Aside from the check protecting feature of the pen, there are several other important departures from the usual style of fountain pen. The first is the method of filling the pen. At the right end we find a screw which when extended causes a lever to press down on the rubber bag. The clip also is provided with a spring inside to preserve and maintain a constant tension on the clip itself.—Security Pen Corp.

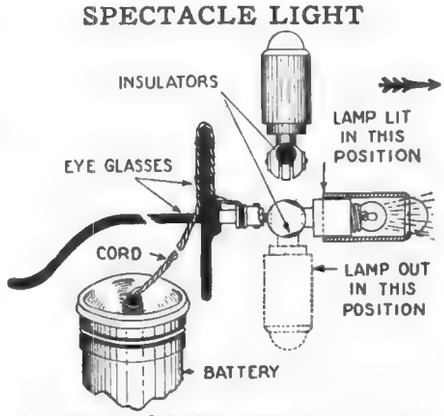
BATTERYLESS FLASHLIGHT





Here is a never failing source of light with no upkeep expense. One merely has to wind it up and turn the switch. A powerful spring motor in the base operates a generator of the magneto type and produces a steady light for 3 minutes on each winding; it can be kept going indefinitely by turning the crank.—Co.

SPECTACLE LIGHT



The diagram of the light attached to spectacles or to extra spectacle rim appears immediately above. Note switching arrangement.

REMARKABLE VIOLIN

The violin was made by Waldo G. Morse, an attorney who spent many years in phonographic researches. The photograph here shows the rough product as well as the finished violin. The face of this violin has a larger proportion of oat hulls, whereas the back has a larger proportion of marl.

Many times the audience of WRNY has been thrilled by the sound of a unique violin played by some of the artists at that station. The violin shown here is made of 1 part of glue, 2 parts of marl and 4 parts of oat hulls. This compound is molded and produces remarkable tonal effects. The product can also be used for loud speakers.

BANDAGE CLAMPS

In Germany a new rubber binding fitted with two clasps is used to hold bandages in place. After the bandage has been applied, the rubber tape ripped by the teeth of the clamps is added and then the tape is wound around the bandage. —Certa-Gesellschaft and T. P. A.

In the photograph above the new spectacle light for the use of physicians, dentists, and nurses is illustrated. This particular device consists of horn spectacle rims at the center of which a unique lamp housing fitted with a miniature bulb and a lens is affixed. This lamp housing is mounted on a pivot at the bridge, and wire leads to the lamp being attached at the edge of the rim and then leads directly to a battery placed in the physician's pocket. The illustration at the left shows the construction of the device itself. It will be observed that there is a small switch making contact with the central strip of the ball-like swivel. This brush does not close the circuit when the lamp is in either vertical position. Glasses may be fitted into the spectacles or they may be worn without or in conjunction with the regular pair.—Comprex Oscillator Co.

MOLDABLE WOOD

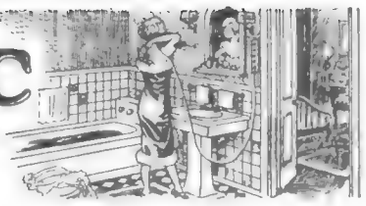
A new product has recently appeared on the American market which is a putty-like substance which when dry, resembles wood. In other words, it is wood to all intents and purposes in a plastered state, and may be used as a crack filler or molded and later carved and cut, stained and painted just like wood.—Addison-Leslie Co.

WIRE FOOD BASKET

The photograph above presents another German article in the form of a wire basket which is lowered into the pot in which p oes or other foods can be boiled and then ved at one time.—F. & R. Fischer and T. P. A.

Addresses of manufacturers furnished on request.

The Home Scientific



ELECTRIC WATER HEATER

Here is an instantaneous hot water heater which is electrical in nature and is attached to an outlet socket. Hot water may be had immediately from the cold water tap. The nozzle fits the cold water faucet. Hot water issues from the spout when the current is turned on.—H. L. G. Mfg. Co. and J. B. Roswick.

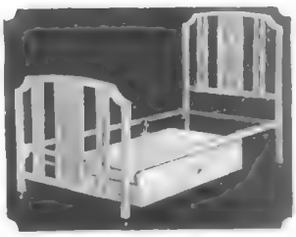
MEAT TENDERER

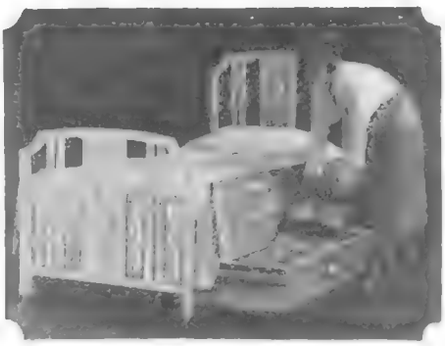
Ths steak tenderer has prong arrangements that permit close operation to the bone so that the entire steak can be made equally tender. It does the work without effort and without tearing or hacking the meat. It is easy to clean, having nothing to take apart and therefore very sanitary. An up and down motion of the hand performs the operation—Harry Kaley and the Taplin Mfg. Co.

The sharp prongs are driven into the meat and break up the long fibers so that when the steak is chewed, it will fairly melt in the mouth. The tenderer also serves the additional purpose of making the steak more juicy.

BED TRUNK

In the photograph at the right a new system of employing the space under a bed is illustrated. At the present time, large quantities of space go to waste in bedrooms and storage space for comforters and the like is at premium. In this system, comforters are conveniently located.

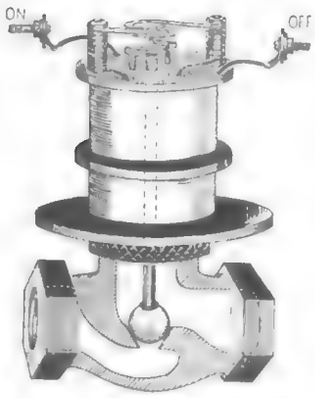


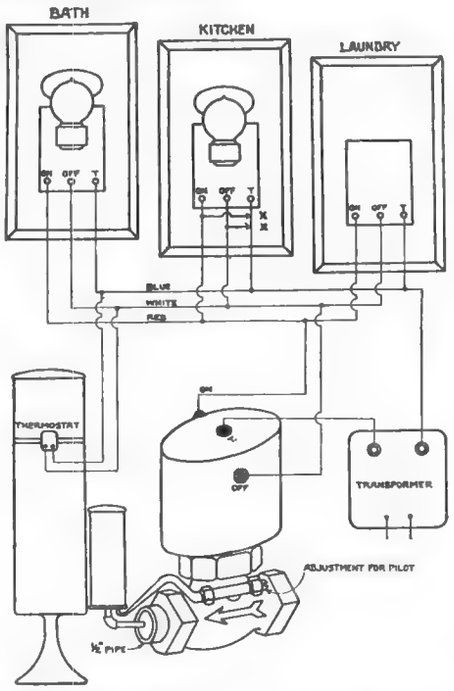


The photograph above shows how the "bed" trunk is fitted under the bed. This trunk rides on rollers which are in a trackway directly attached to the bed so that if the bed is moved, the trunk likewise shifts. Notice that the trunk has its own cover.—Space Saving Furniture Co.

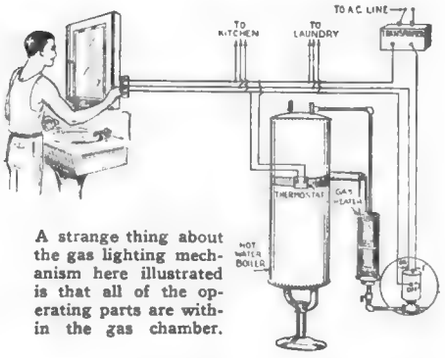
PRESS BUTTON—HOT WATER

At the right is the mechanism which controls the supply of gas in this device. There are two solenoids actuating the valve either turning the gas on or off as desired.



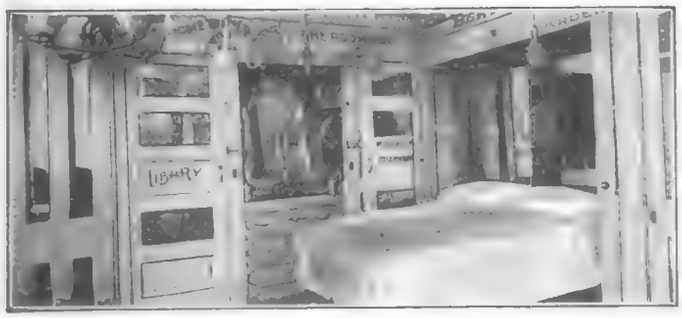


The diagram at the right shows the installation of a mechanism to turn on the gas in the cellar from either the bath-room, the kitchen or the laundry. The three panels indicated give us a back view of the fittings which are mounted on the walls of the respective rooms. When a button is pressed, current from a bell ringing transformer raises the valve and permits the gas to flow through the hot water heater. The gas is lighted by a pilot and at the same time a red light shows indicating it is on. Should the boiler become overheated, the thermostat turns off the gas. X—X on kitchen panel shows circuit of switches.—Sav-u-time Co.



A strange thing about the gas lighting mechanism here illustrated is that all of the operating parts are within the gas chamber.

TABLOID FLAT PRESEN TS MANY ROOMS IN ONE



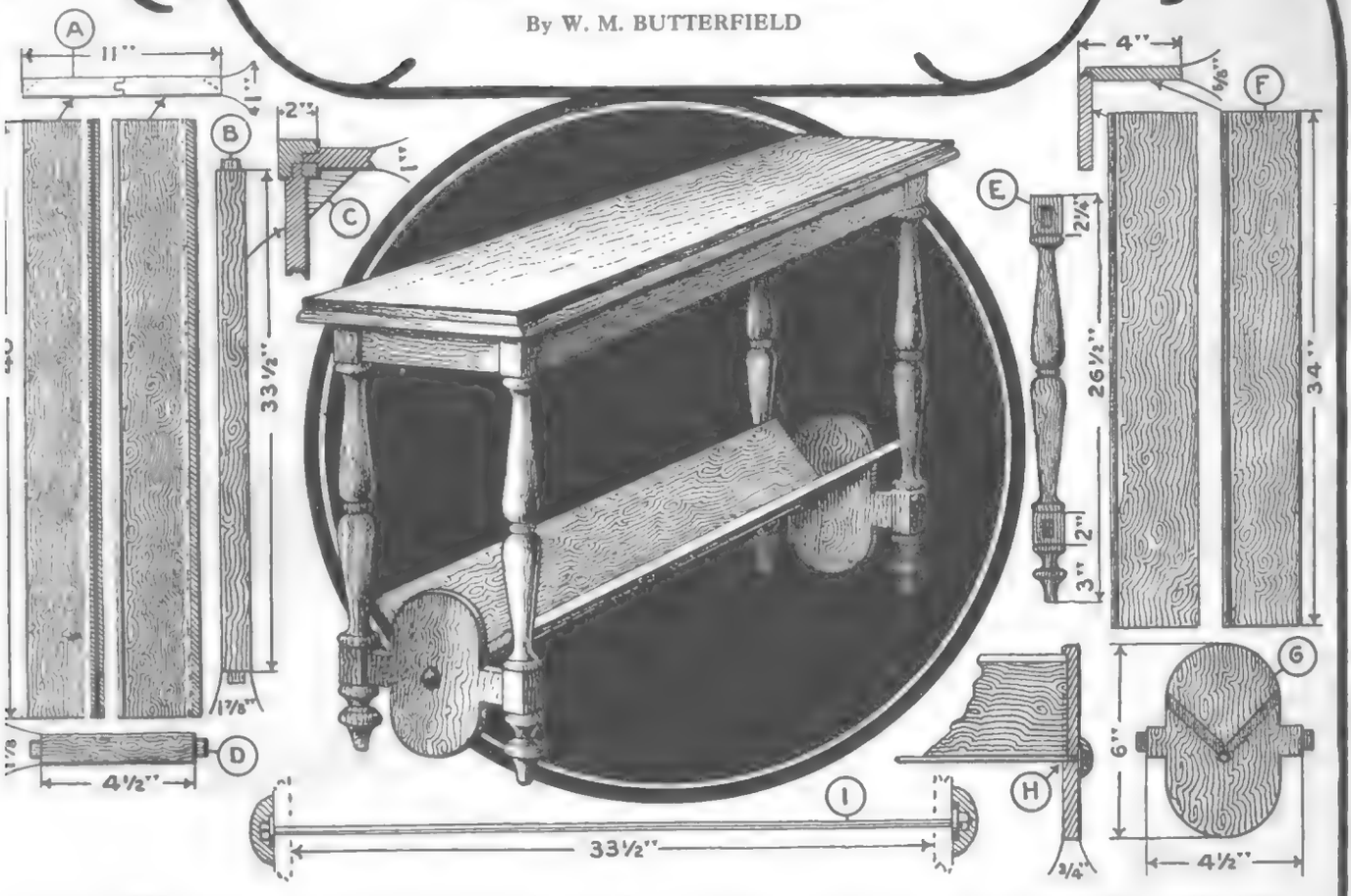
A Cincinnatian, Edward Beall, has proven that one may live in perfect comfort with every convenience in a one-room flat. The actual dimensions of the room itself, at least those visible, are 6x9 feet. There are signs on the walls indicating what lies behind the sliding doors. Pressing against the door at one side causes it to open and a folding bed attached to the inner side of the door comes down gently. In a farther corner of the room another door opens to the bath. Behind a door in the rear wall is an entire pantry and cooking outfit, the sides, ceilings and floors being covered with galvanized iron to prevent fire. Adjoining this there is a compartment containing a sink and another, containing an ice-box. With all these open we have an ideal kitchen. A table is then let down from another door behind which there is room for China and silverware. When all trace of a kitchen is removed, we have a dining room. There are compartments for a library, wine cellar, telephone and four berths for guests.—F. J. Koch.

(Names and addresses of Manufacturers may be obtained upon request)

Home Mechanics

A Book Trough End Table

By W. M. BUTTERFIELD



The Home Mechanic will find a good use for his talents in building this very useful and desirable Book Trough End Table. This piece of furniture may be finished with high gloss varnish, or else in mission style with a wax finish. This table may be made from cheap wood properly stained, or if possible it should be made from mahogany or walnut. Veneered wood is available for the purpose.

THE book trough end table has become popular by reason of its novelty or perhaps from its supposed convenience. At any rate, it is a very much admired piece of furniture. It is manufactured in various woods—walnut, mahogany, maple or oak, and is to be had in various sizes and styles ranging from the diminutive table 20 inches high, 9 inches wide and 24 inches long to tables having proportions given with our illustrations for this article.

In all cases the object is the same, namely, to provide a long, narrow receptacle for a limited number of the "best sellers," favorite authors, and the like. It is considered quite "smart" nowadays to have several of these tables distributed throughout the house, and placed in close proximity to favorite loungechairs, settees, etc. Sometimes the table top is filled with a row of books, backs uppermost, and held in place with heavy bronze end pieces; at other times the top is used to support an electric reading lamp, and carelessly piled books, laid sides down, arranged flanking the lamp at either end. Books are placed in a single row, and in an inclined position, in the trough.

Although the tables present the appearance of high class workmanship, they are, nevertheless, quite easy to make. Outside of the four turned legs, the two buttons covering the rod ends, and the moulding on the edges of the table top, the tables can be easily made by any home mechanic. The local lumber yard mill can solve all difficulty for the most indifferent worker, and will turn out the legs, buttons and the moulding at little more cost than the price of the lumber. It might be well to leave this article with the mill man, depending on his experience for furnishing the parts in the best and easiest working shape. The list of lumber and parts is as follows:

6 feet 10 inches of 1⅛ inch lumber 6¼ inches wide.

10 feet 2 inches 2⅛ inch by 2⅛ inch lumber.

1 foot 3 inches of ⅞ inch lumber 5⅝ inches wide.

5 feet 9 inches of ⅝ inch lumber 4⅛ inches wide.

1¼ inch rod with head, washers and nut 33¾ inches long under head.

10 2 3-16 inch screws.

8 1 inch screws.

We show the top of the table as formed of two pieces, each 6¼ inches wide. The object is to provide a more pleasing grain when finished and to prevent warping. This is accomplished by marking a board on one side in two places before sawing into lengths, then gluing together with the marked sides reversed—one on top and the other on the bottom. A ⅜ inch groove, ⅜ inch deep is cut with the rabbeting plane in one piece and a ⅜ inch tongue slightly less than ⅜ inch long is cut on the other piece. This joint must be accurately fitted, showing no joint before gluing, and must be a tight fit at all points. After gluing the top is smoothed down to 1 inch thick, 11 inches wide and 40 inches long, it is then ready for the moulding machine. It is fastened to the top rails with screws 2 3/16 inches long driven through the rails from the bottom.

B. and D.—Four top rails are used 1 inch thick and 1⅞ inches wide. Two are 34½ inches long with tenons ½ inch long at each end, or 33¼ inches long between tenons; two are 5½ inches long with ½ inch tenons at each end, or 4½ inches between tenons. Two form the side rails and two the end rails. The tenons should be cut leaving a ⅛ inch shoulder on each four sides. The rails sit flush with the top of the legs.

C. and E.—The legs are 26½ inches long 2 inches square and have a turned spindle and foot 2 inches in diameter at the largest points. There are two right legs and two left legs. Mortises are cut in the legs to fit the tenons on the top rails and for the tenons on the end, boards or under-braces G. These must be cut very accurately and fit the tenons tight and snug at all points. Every joint must be fitted together carefully and surely before gluing. In fact, it is wise to fit the table together before any glue is used at all; if the mortises and tenons fit properly this can be done, and any possible twist or pull in the various joints may be detected and repaired. Screw holes should be bored

(*Continued on page* 1059)

MAGIC By "DUNNINGER"

DUNNINGER
DUNNINGER AMAZES TRAINED EMPLOYEES IN DEMONSTRATION
Joe Dunninger Tells How Prince Got Trick to Show Home Folks
HYPNOTIST RULES SUBJECT BY RADIO
Reads Mayor's Inner Mind

THE MAN WHO MYSTIFIED
Pres. Coolidge
Prince of Wales, Ex-President Harding, Taft, Roosevelt, and other celebrities
Writes Exclusively for
SCIENCE AND INVENTION

Folks Are Mystified Yet Delighted by This Man!
Mind Your! The Mind Reader Really Read the Mayor's Mind!
DUNNINGER DRAWS MORE BIG CROWDS
Dunninger Will Attempt To Hypnotize Patient, 10 Miles Away, by Radio

NO. 48 OF A SERIES

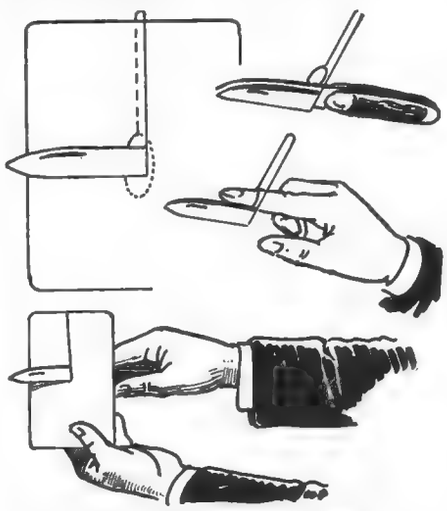
Handkerchief and Confetti Trick

As indicated above, two kerchiefs are placed in two glasses mounted on the table. A cloth is held in front of them and the kerchiefs mysteriously change into confetti. The appliance illustrated is employed.

THE conjurer exhibits two ordinary drinking glasses, which may be passed for examination, and then places them on an undraped side stand. He puts a blue silk kerchief in one and a red kerchief in the other. The wizard now holds a borrowed linen handkerchief momentarily in front of the glasses. When it is removed, red and blue confetti will be found in the glasses. The kerchief's have disappeared. The trick is accomplished with the aid of a trick table, having a lever working on hinges and carrying two metal envelopes for the confetti. The lever is lifted under cover of the linen kerchief and the string is pulled to remove those in the glasses.

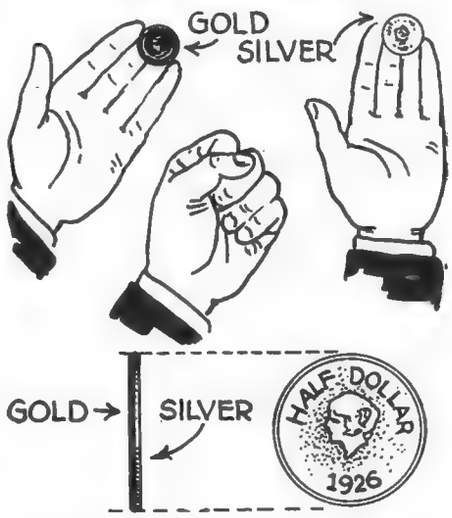
Mystic Knife Trick

HERE is another original problem which will be found effective. It should be presented a short distance from an audience in order to protect the illusion. A pocket knife is passed for inspection and then a playing card is selected from an ordinary deck. The magician, picking up the card, proceeds to cut it as illustrated. A moment later, both card and knife are again passed and the card will be found in no way injured. The trick is accomplished by the aid of a duplicate knife blade a little shorter than the original, to which a piece of steel wire, bent as illustrated, has been soldered. The loop fits the index finger of the hand, and encircles the card so that the knife blade apparently projects from the card. The thin wire connecting to the knife blade enhances the cut-like effect



By the aid of a blade of a knife fastened to a thin wire and the wire looped to fit the finger, one can apparently cut a card and immediately restore it again.

Gold and Silver



A gold coin held in one hand and a silver coin held in the other mysteriously change their places when the hand is closed. The coins are made in halves, fastened together as the diagram above indicates.

TWO coins are shown. In size they resemble the American half-dollar, but one is of gold and the other of silver. One of these is placed in the right hand and the other in the left. With the hands quite a distance apart and away from the performer's body, the magician closes his fist upon the respective coins. When the hands are opened, the pocket pieces are found to have mysteriously changed places. As an explanation, it would be advisable to state that the coins are prearranged. Half of the coin is gold and the other half silver. When placed on the ends of the fingers, it is natural that in closing the hand, the coins are turned over.

Egg-Straordinary

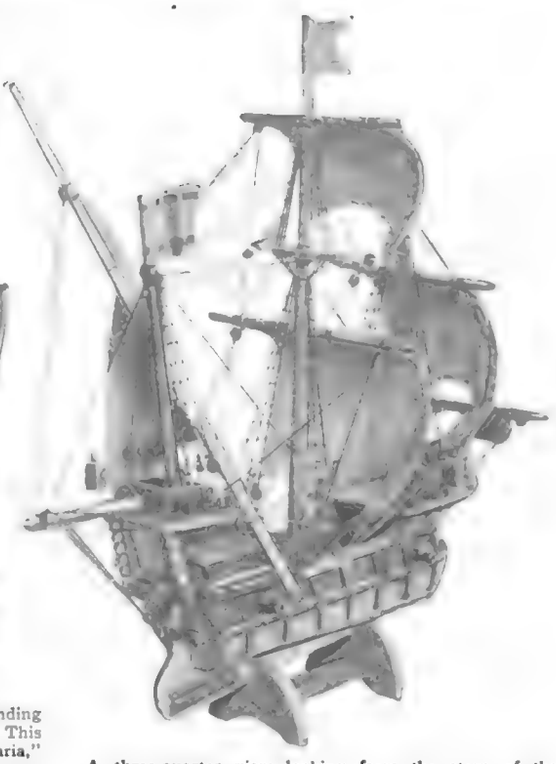
An excellent comedy trick. The magician requests the loan of a gentlemans pocket kerchief and persuades the victim to assist him with the problem. An egg is chosen from a tray, placed under cover of the pocket kerchief and struck with a hammer. The owner of the handkerchief realizes that it will never be the same, but, when the magician shakes it by its corners it is quite intact. Secret. The magician prepares himself with an empty egg shell and a small cloth bag attached to an elastic. Beneath cover of the kerchief the real egg is placed in the vest pocket and the blown egg and sack put under the handkerchief. It is the blown egg which is struck with the hammer and the pieces are carried up the sleeve.

MODEL DEPARTMENT

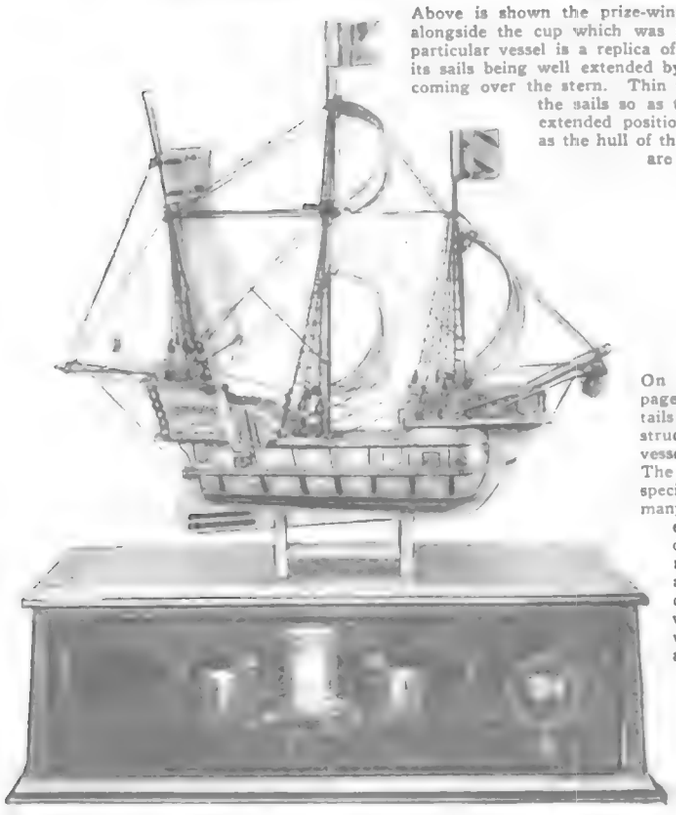
"Santa Maria" Wins Trophy

Model Entered by Clara J. Bierbower of Philadelphia Wins Ninth SCIENCE AND INVENTION Model Cup—First Woman to Win a Cup in the Model Contest

Above is shown the prize-winning model standing alongside the cup which was awarded to it. This particular vessel is a replica of the "Santa Maria," its sails being well extended by an apparent breeze coming over the stern. Thin wires are sewed into the sails so as to keep them in this extended position. The sails as well as the hull of the vessel and the flags are painted.

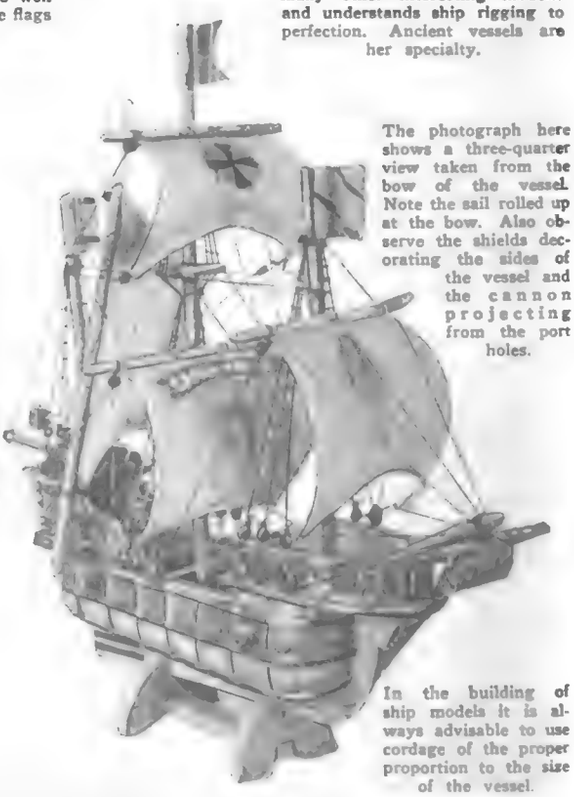


A three-quarter view looking from the stern of the prize-winning "Santa Maria" made by an active model builder of the fairer sex. Mrs. Bierbower has built many other interesting models, and understands ship rigging to perfection. Ancient vessels are her specialty.



Above is a photograph of the prize-winning idea entered in this month's contest as it would appear if placed on a radio set. Ships of this nature are very fascinating both to build and to decorate, and when the work has been finished, the builders will rarely sell the vessel for less than five times its actual cost. The flags in this model are of painted metal.

On the following page the full details for the construction of this vessel are given. The color is not specified because many model builders prefer to decorate their models in such a way that the color scheme will combine with other articles of furniture.

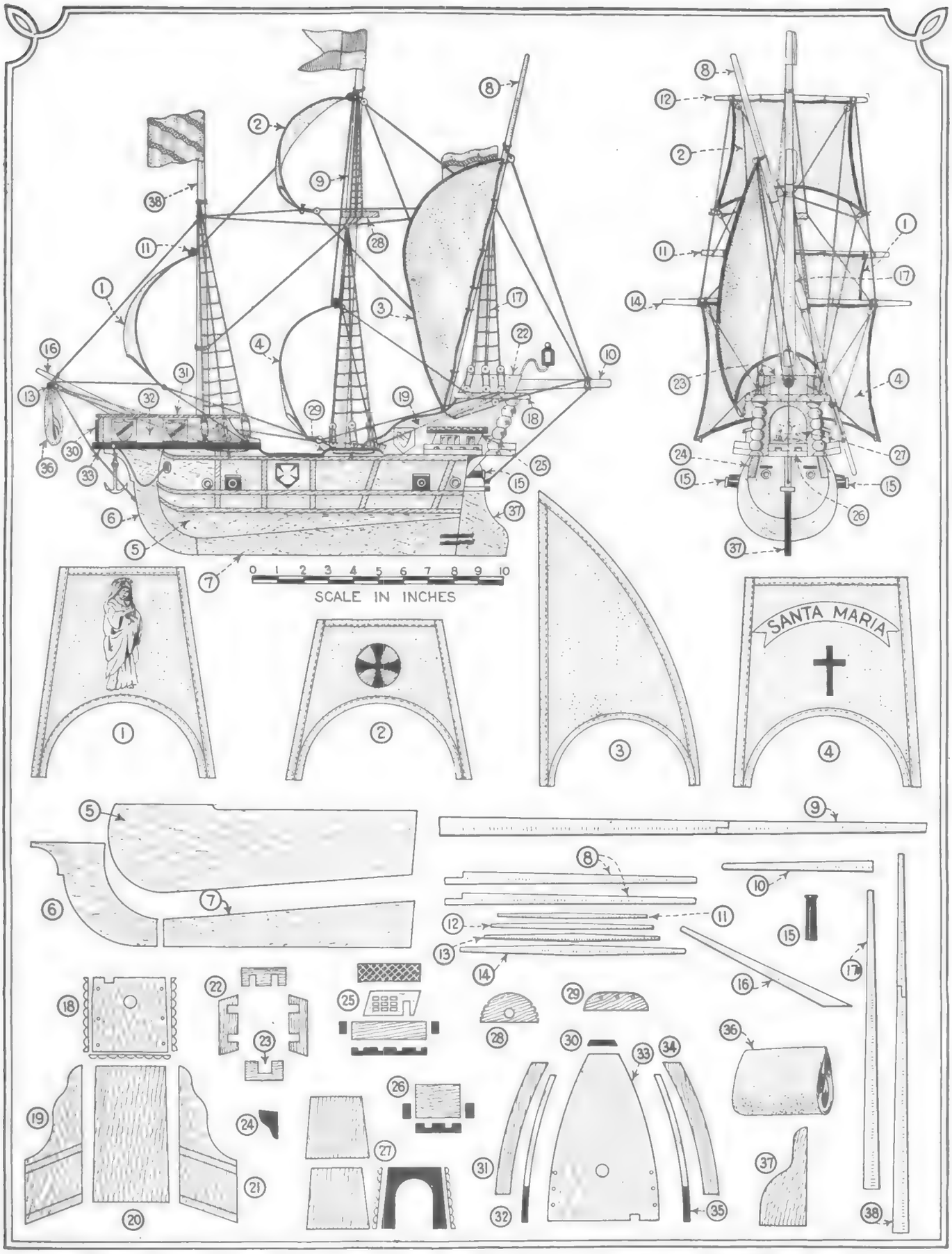


The photograph here shows a three-quarter view taken from the bow of the vessel. Note the sail rolled up at the bow. Also observe the shields decorating the sides of the vessel and the cannon projecting from the port holes.

In the building of ship models it is always advisable to use cordage of the proper proportion to the size of the vessel.

Blue-prints of Models are available from the Model Department. Rules for model contest appear on page 1063.

Details of "Santa Maria"



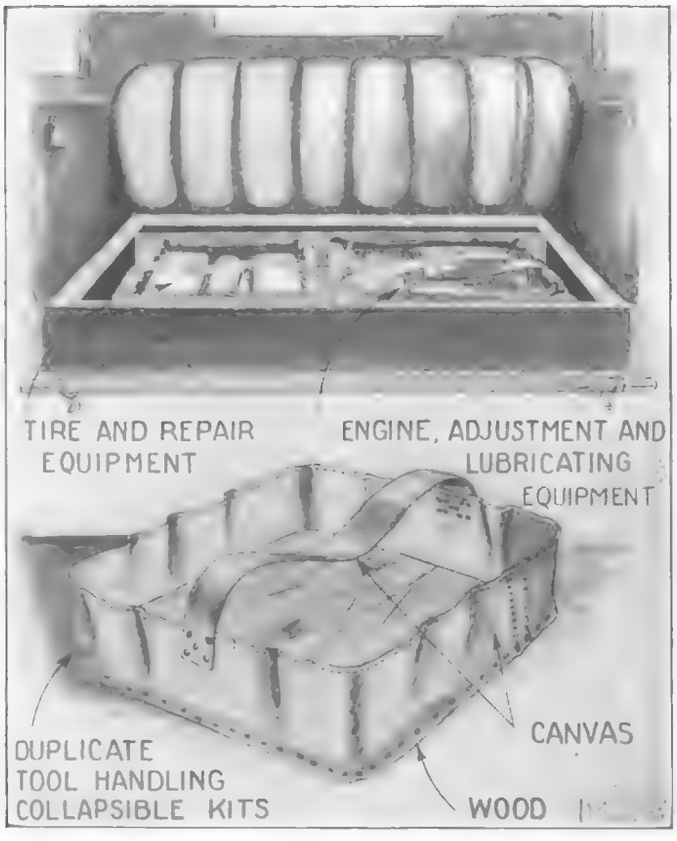
Here is a diagram showing how to build the Santa Maria, the vessel which won the cup in the SCIENCE AND INVENTION Model Trophy Contest. In this particular contest a large cup, 17½ inches high is awarded monthly for the best model of any article submitted dur

MOTOR HINTS

Conducted by GEORGE A. LUERS

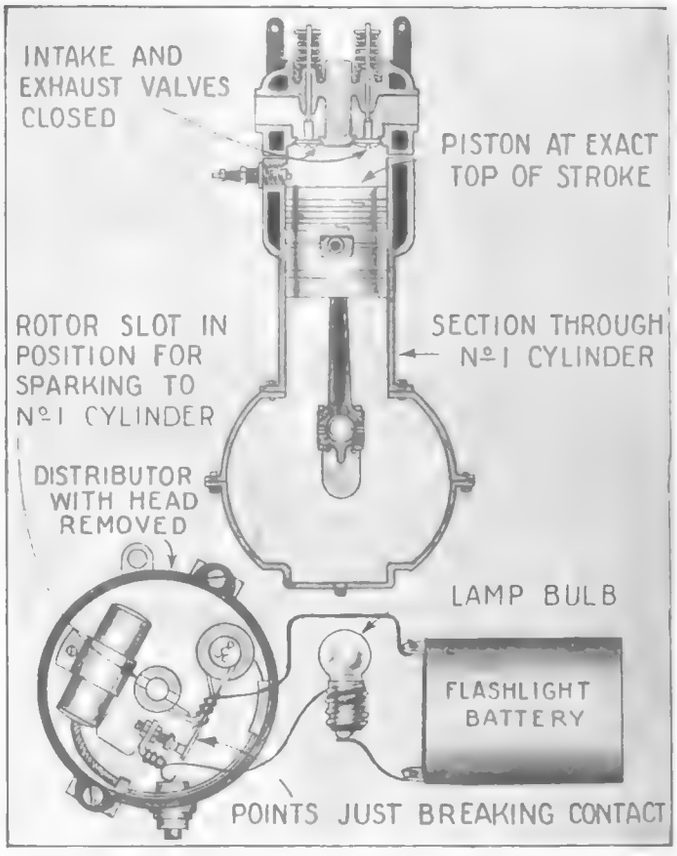
A New Monthly Department Prepared by a Well-Known Automotive Engineer

FACILITIES FOR GROUPING CAR TOOLS



The tool tray idea illustrated above will be found very practical by every motorist. It keeps certain tools together in one group, saving much time.

TESTING IGNITION WITH BATTERY AND BULB


INTAKE AND EXHAUST VALVES CLOSED
PISTON AT EXACT TOP OF STROKE
ROTOR SLOT IN POSITION FOR SPARKING TO Nº1 CYLINDER
SECTION THROUGH Nº1 CYLINDER
DISTRIBUTOR WITH HEAD REMOVED
LAMP BULB
FLASHLIGHT BATTERY
POINTS JUST BREAKING CONTACT

The picture above shows a simple method which may be used for checking up the timing of the ignition on your engine with battery and lamp.

AN excellent idea for handling automobile tools, is used by many motorists and is shown in the attached sketch. This idea will be appreciated by drivers, especially when the car is of the type in which the tool compartment is under the rear seat and there is only a few inches of space under the low hung bodies, as used on the newer cars.

In the sketch, a boxlike bag is shown, which occupies one half the tool compartment. This bag is made in duplicate, each section fitting half of the compartment.

The bottom of the bag is of wood, while the upper part is made of canvas, with a canvas handle. In this way the bag is of considerable depth when lifted, but tucks away under the lowest seat.

In one bag, tire tools, tire repair material, pump and other equipment for making road repairs is stored. In the other bag, the tools for adjustments, engine repair, greasing and spark plug tools are carried. This idea will solve the perplexing problem of tool handling in a satisfactory manner.

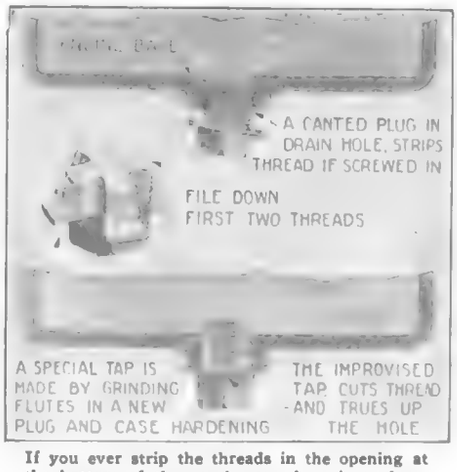
CHECKING UP ON IGNITION WITH A BATTERY AND BULB.

Several weeks ago one car owner came to an abrupt halt on the road, while the exhaust gave forth occasional violent explosions.

This owner had recently been in the repair station for reason of ignition failure

"DO YOU KNOW, if battery liquid shows a 1150 hydrometer reading, it will freeze readily. Repairs to a frozen battery cost practically as much as the cost of a new one."

and the mechanic had adjusted the distributor to make the firing order coincide with the piston movement. It so happened, however, that the real trouble was due to the loss of a connecting taper pin between the timing gears and the distributor shaft and only a temporary hold was existing between the two shafts.


A CANTED PLUG IN DRAIN HOLE, STRIPS THREAD IF SCREWED IN
FILE DOWN FIRST TWO THREADS
A SPECIAL TAP IS MADE BY GRINDING FLUTES IN A NEW PLUG AND CASE HARDENING
THE IMPROVISED TAP CUTS THREAD AND TRUES UP THE HOLE

If you ever strip the threads in the opening at the bottom of the crank case, here is a clever way of re-threading the opening.

This was found to be the condition when road repairs were attempted on the car. The entire ignition setting had to be made correct before the engine could be started.

To time the ignition, as was done in this instance, the following procedure was used:

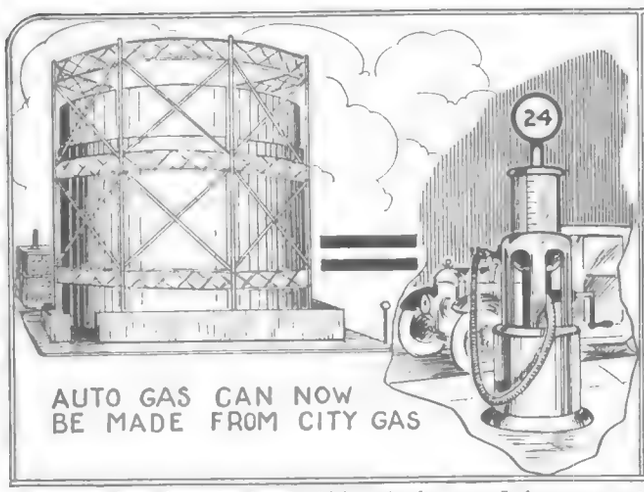
1. The spark lever was set in the retarded position.
2. The spark plug from number one cylinder was removed and through this opening a small rod was placed to determine when the piston was at the exact top of the stroke and both valves closed.
3. The lead to number one spark plug was determined and the rotor position for firing at this time was determined.
4. The distributor shaft was turned to bring the rotor slot and cam around.
5. A small piece of wire was used to connect up the blades holding the breaker points and a small flashlight bulb and battery was connected in circuit. The adjusting screw was then turned so the points separated to the point where the light went off.

The illustrations show the position of the piston and valves in number one cylinder and the second part of the illustration shows the connections for the bulb and battery.

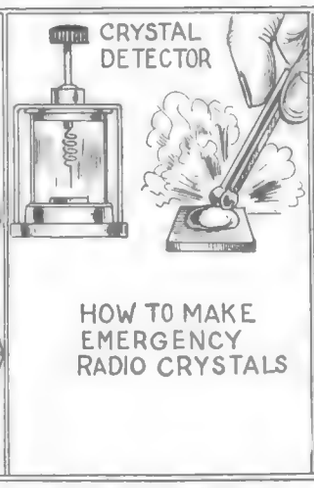
(Continued on page 1061)

Everyday Chemistry

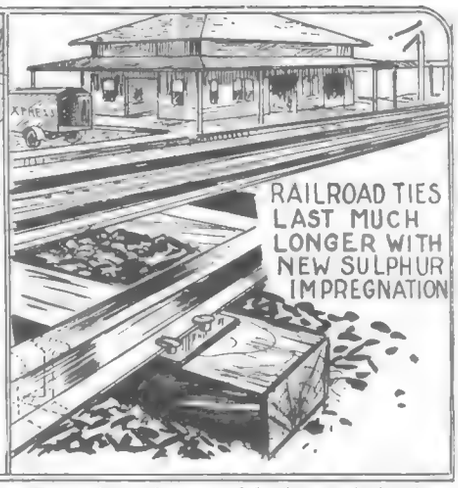
By RAYMOND B. WAILES



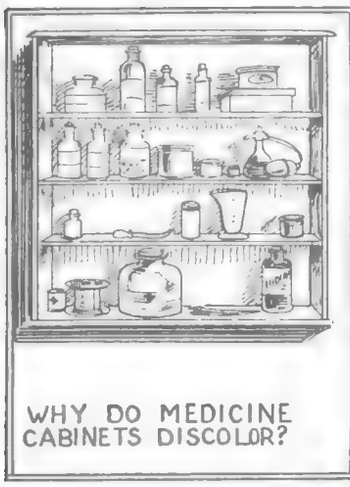
Processes have been developed which make it possible to produce a combustible liquid fuel from common illuminating gas by subjecting the gas under high pressure to the action of a catalyst. This fuel may be used in internal combustion motors, and it may some day supplant gasoline for our automobile and other engines.



It is very easy to improvise a crystal for your crystal detector if you find it necessary to do so. Melt a drop of solder as big as a crystal cup and hold the live heads of two matches upon it. The heads will burn and form a coating of sensitive lead sulfide, "artificial galena," upon the solder.



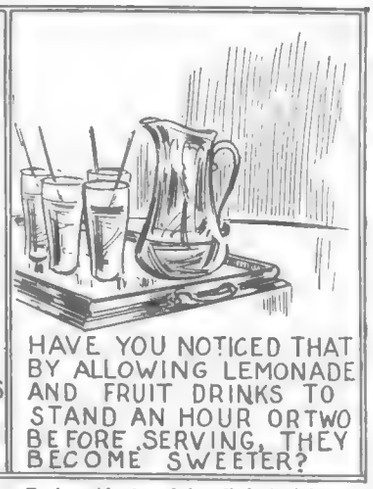
Research on the part of lumber producing industries has brought out the information that railroad ties and other wood impregnated with sulphur lasts longer than creosoted ties. Sulphur is highly resistant to weathering and insect destruction, and this development in its use gives promise of further useful applications.



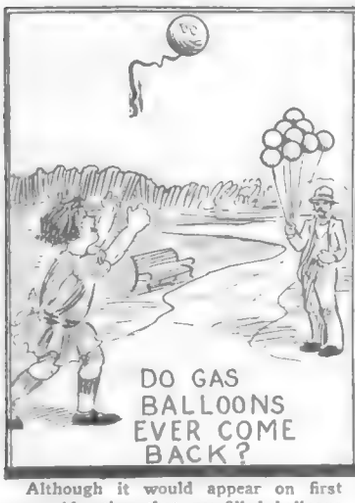
The frequently-noted discoloration of white enameled medicine cabinets seems mysterious. As a matter of fact the explanation is very simple. The vapor from the universally used tincture of iodine reacts with lead paint to form a yellow iodide of lead.

Most electric trains are equipped with brakes which cause the train to stop by electrical means rather than mechanical. Sparking may occur as a consequence of this action, and is usually accompanied by the production of ozone, hence the odor.

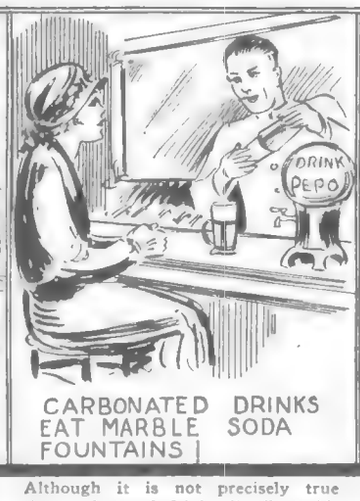
Glass, as in the case of nearly all other substances, is more or less soluble in water. This action is infinitesimal, but a minute amount of glass is dissolved in the rain water beating upon window pains during each shower.



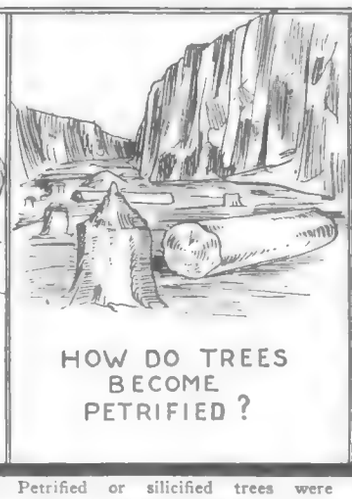
Fruit acids found in all fruit juices react with cane sugar, slowly but surely, to form other sugars which are somewhat sweeter than cane sugar. If sugared fruit drinks are permitted to stand for some time, they become considerably sweeter.



Although it would appear on first consideration that gas-filled balloons would rise indefinitely, such is not the fact. However impervious the tissue of the balloon may be, the molecules of hydrogen will eventually find their way out.



Although it is not precisely true that carbonated drinks "eat" marble soda fountain, the carbonic acid contained in carbonated water reacts with the marble of the fountain-top, to form calcium bicarbonate which is a soluble salt.



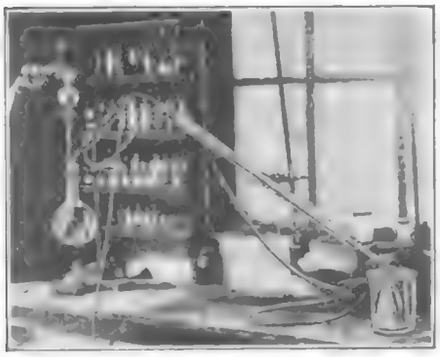
Petrified or silicified trees were formed by being exposed to water which contains silica, the component part of sand, in solution. The water was introduced into the cells of the wood and broke down the tissue, leaving the silica behind.

Diluted storage battery acid may be used very nicely as "invisible ink." Write with a gold or glass pen point on white paper; the writing will be invisible until the paper is heated, when the hot sulphuric acid carbonizes it, giving brown to black marks.

Experimenting with Aldehydes

By DR. ERNEST BADE

THE aldehydes are dehydrogenated primary alcohols and a number of them exist as such in certain essential oils of plants. The simplest member of this type is formaldehyde, a gas, which, when dissolved in water containing about 15% of wood alcohol, is known as formalin. It is an antiseptic and disinfectant. As an antiseptic a



Sulphuric acid is brought to a boiling point in the little flask. An alcoholic solution of potassium bichromate is put into the separatory funnel and is allowed to drip into the alcohol.

few drops will keep a large quantity of material fresh, but its use for preserving food is undesirable. A sensitive test for its presence may be applied. To ten cubic centimeters of the suspected solution add 2 cubic centimeters of a 1% solution of phenylhydrazine hydrochloride and 1 cubic centimeter of a 5% solution of potassium ferricyanide. Mix and add a few drops of concentrated hydrochloric acid. When formaldehyde is present a rose red tint is developed. Formaldehyde has also been used to preserve milk. Dilute the milk with an equal quantity of water, add a few drops of concentrated ferric chloride solution and mix. Carefully add concentrated sulphuric acid so that it descends to the bottom of the test tube; the other solution will float on top of it. If formaldehyde is present, a violet colored ring will be formed on the surface of the sulphuric acid between the two liquids.

Here aldehyde as produced, is placed in the flask and very gently heated. Reflux condenser returns impurities to the flask while the pure aldehyde passes over and is collected in two ether bottles, the last catching what the first one missed.

Acetaldehyde, the second member in this series, has a boiling point of 21° C., and since it is very difficult to separate the acetaldehyde from impurities by fractional distillation, the acetaldehyde is first changed into a salt which is later decomposed resulting in the formation of the pure liquid. Quite a little skill in handling chemicals and apparatus is required to give efficient results, but with care any laboratory enthusiast will obtain satisfaction from the experiment.

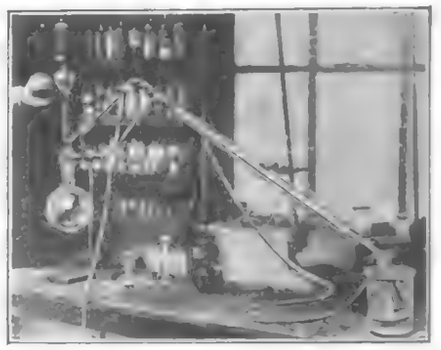
Ethyl alcohol is oxidized by means of sulphuric acid and a bichromate and the resulting aldehyde is collected in a freezing mixture. Into a liter flask put 125 cubic centimeters of water and carefully add 30 cubic centimeters of concentrated sulphuric acid and mix. Place a two-hole stopper in the flask and through one hole pass a dropping funnel and through the other a slightly bent goose-neck tube. The dropping or separatory funnel is used to control the flow of the aldehyde generated. The slightly bent goose-neck carries a very short condenser used as a reflux, which condenses vapors of the higher boiling points and brings them back into the flask. A very long condenser is attached to the short condenser, and this condenser points downward so that the volatile aldehyde may be condensed. The condenser terminates in an adaptor or tube bent downward and leading into a small flask which is placed in ice and salt or in other freezing mixture.

Now prepare, in a beaker or flask, a solution consisting of 100 cubic centimeters of water and 80 grams of sodium bichromate to which 75 grams of alcohol, medicated, grain or ethyl alcohol marked "for external use," may be employed. Mix thoroughly and fill the dropping funnel with this solution. Then heat the flask until the solution just begins to boil. In the meanwhile place the receiver in ice water, ice and salt or other freezing solution. Then let the water pass through the condensers and open the stop cock of the dropping funnel slightly so that a small, thin stream passes into the slowly boiling solution.

During the addition of the bichromate mixture, it will hardly be necessary to heat the flask for the reaction which takes place is of such a nature that it is sufficient to cause ebullition. The aldehyde formed, together with some alcohol and acetal, is vaporized and enters the short reflux condenser.

If uncondensed vapors of aldehyde escape from the receiver, the mixture from the dropping funnel is added more slowly, and if the contents of the large flask does not boil gently, as the mixture from the funnel is added, then a small flame is brought under it so that the reaction may be more complete. When all the mixture has been added, continue to heat the flask with a small flame for a number of minutes in order to complete the reaction as much as possible.

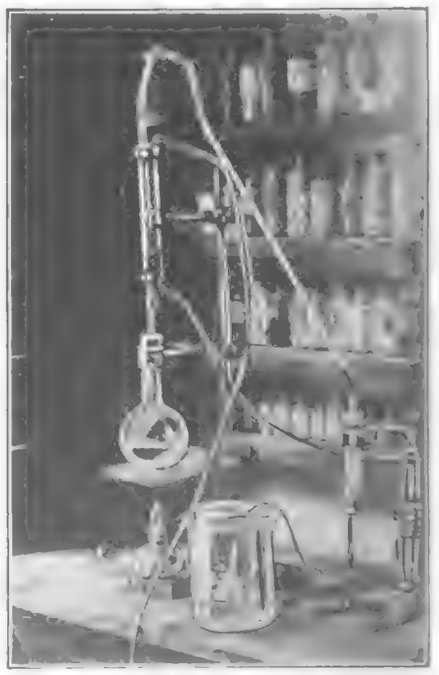
The impure acetaldehyde in the receiver is now removed and placed in position for boiling. This time a one-hole stopper is used and the short reflux condenser is connected. From the reflux condenser a glass tube is brought down to the table and an adaptor or inverted thistle tube is attached



This shows a second step in the process where the alcoholic bichromate solution is allowed to drip into the boiling sulphuric acid.

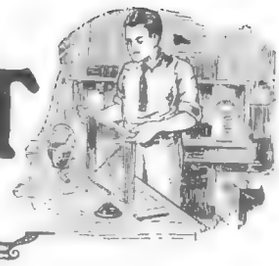
to the tube. The end of the wide tube reaches slightly below the level of a bottle containing 50 cubic centimeters of ether. This bottle is provided with a two-hole stopper, a tube passing through the other hole leads to a second bottle containing 50 cubic centimeters of ether.

Fill the short condenser with water having a temperature of 35° C. and gently heat the

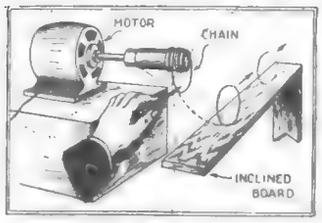


Strong ammonia solution is put into the flask and by gentle heating ammoniacal gas is evolved, passes through the reflux condenser and through a drying tube and into the ether solution of aldehyde contained in a beaker surrounded with the freezing mixture. Crystals of ammonium aldehyde are thus formed.

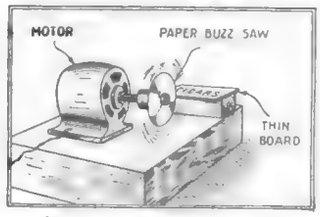
HOW TO MAKE IT



A Magic Chain and a Paper Buzz-Saw



A small electric motor will provide a great deal of amusement to those interested, and may possibly do a lot to illustrate a scientific principle. A chain loop hung on the shall of a fast-revolving motor forms a rigid ring which may be caused to roll up-hill.



If a paper buzz-saw is revolved at high enough speed, as illustrated at the left, it will be possible to cut cigar box wood with it. The method of fastening the paper disc is illustrated at the right.

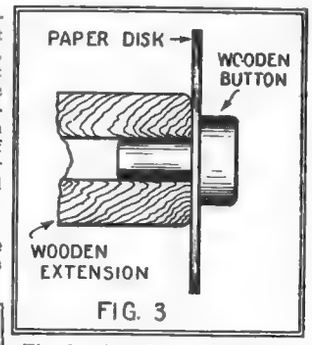


FIG. 3

The drawing above illustrates the method used in fastening the paper buzz-saw disc to the wooden extension on the conical mandrel of the driving wheel. The first experiment, that involving the chain, illustrates the action of centrifugal force in causing a chain running at high speed to tend to assume a rigid open form. The effect lasts until the speed falls to a point where the centrifugal force is too weak.

These experiments may be performed with the aid of a sewing machine instead of an electric motor, if a wooden extension sleeve is fitted to the shuttle-driving wheel of the sewing machine. The extension sleeve is necessary to prevent the chain from striking the sewing machine at high speed, as this might result in injury to the experimenter.

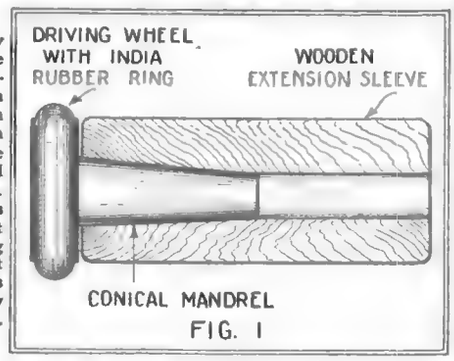


FIG. 1

A paper tube is slipped over the end of the wooden extension sleeve, with two paper rings glued to the outside of the tube as guides.

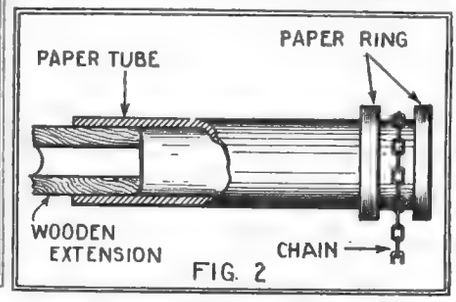
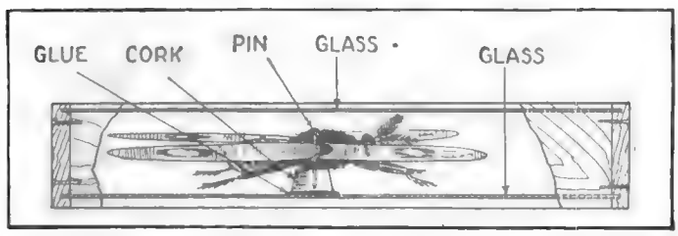


FIG. 2

An Excellent Method of Mounting Specimens



HERE is a very excellent stunt for the entomologist, who is more commonly called a "bug catcher." When the specimens are to be mounted for future inspection, it is desirable that the mounting be arranged to permit both sides of the specimen to be seen without removing the specimen from the case. If two sheets of glass are mounted about 1¼ inches apart, separated by a wooden frame, the specimen may be pinned to a cork to be glued to one of the glass plates. Perhaps the simplest way to hold the glass in place is to first build up the frame out of cigar box wood or similar material, cut the glass plates to size, and then fasten them in place by the use of passe-partout paper.

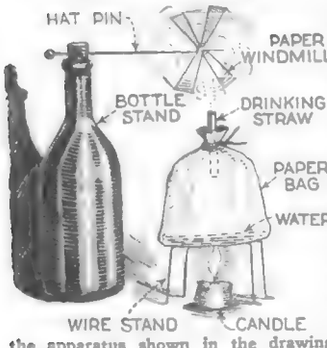
Above will be seen an illustration of an unusually beautiful specimen of a rare moth which has been placed in one of the cases of the type referred to. There is no reason why it should not be possible to mount specimens other than butterflies and moths in this kind of case; it occurs to us that it would be an ideal method of preserving the dried skins of small snakes.

At the left is a view of the same specimen from the top. If this type of case is utilized, it is possible to file specimens as one would stack books, with the name at one end. (Author, please send address.)

WRINKLES
RECIPES & FORMULAS

Edited by S. Gernsback

PAPER STEAM ENGINE

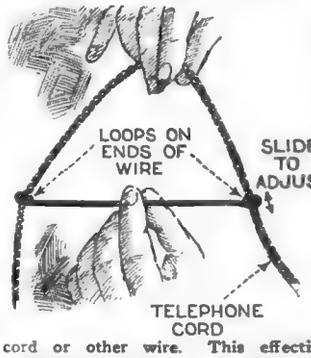


A few experimenters are familiar with the fact that water may be boiled in a paper bag, but it is doubtful if many of them have tried utilizing the steam thus generated to operate a model engine. By assembling the apparatus shown in the drawing at the left, such may be done.—F. C. Jones.

MINIATURE VOLCANO

Here is another stunt which is more or less familiar in principle to all who have made a study of chemical novelties. Required: A small amount of potassium permanganate ($KMnO_4$) finely divided, which is formed into a shape more or less resembling a mountain with a crater at its peak, and a few drops of glycerine.—F. Bishop, Rep. No. 25,545.

KINK-PROOFING WIRE

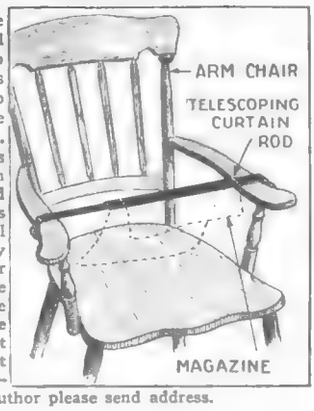


A length of bus bar about 3 inches long and a pair of round-nose pliers fulfil the manufacturing requirements of this useful device. A 3/16ths inch loop at each end of the bus bar is fastened as shown about the telephone cord or other wire. This effectively eliminates kinking.—Arthur Leventhal Rep. No. 27,898.

REMOVING DEVELOPER STAINS

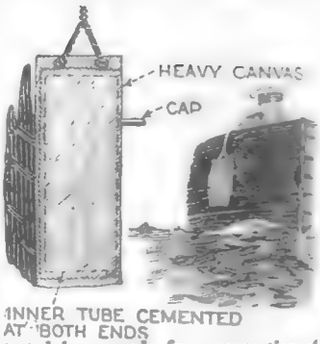
Stains on the fingers from developer solutions, particularly from pyro, are the bane of every photographer. Heat equal amounts of olive oil and beeswax until the latter liquefies. When cool, apply to fingers, rubbing in well and wiping off excess to prevent finger-printing the negative.—D. R. Hoag.

MAGAZINE REST



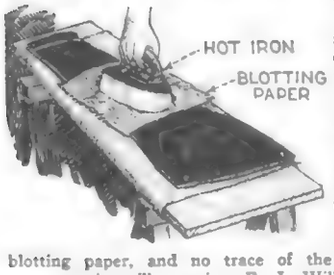
Here is a more or less novel idea to use up old curtain rods which have no other excuse for existence. The theory is that a curtain rod placed across the arms of a chair will make a very nice newspaper or magazine rack for the occupant of the chair. Don't say we didn't warn you.—Author please send address.

PNEUMATIC BOAT FENDER



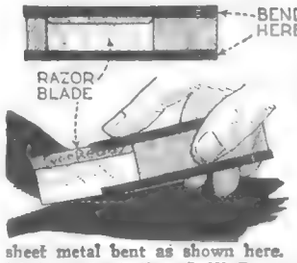
The lucky person who owns a nice looking motor boat is usually desirous of keeping it in as good condition as possible. One of the best ways not to do so is to permit the boat to bump into the landing-stage. A buffer as illustrated here, made from a section of inner tube and a canvas bag, is recommended.—Arthur Moyer.

CANDLE GREASE SPOTS



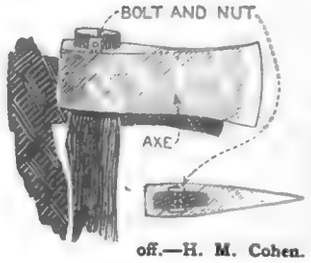
To remove candle grease spots which cannot be rubbed off, use this method. The hot iron will cause the candle or other grease to be absorbed from the cloth to the blotting paper, and no trace of the troublesome stain will remain.—F. J. Wilhelm.

RAZOR BLADE HOLDER



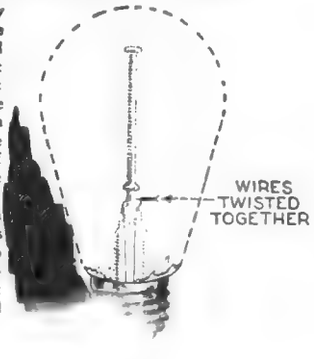
What does the miser do with his old razor blades? Ha, ha! He shaves with them! We don't recommend such methods, but instead we suggest that you use a holder made of thin sheet metal bent as shown here. Result, a useful fabric-cutting knife.—C. W. Brown, Rep. No. 24,960.

SAFETY FIRST AXE



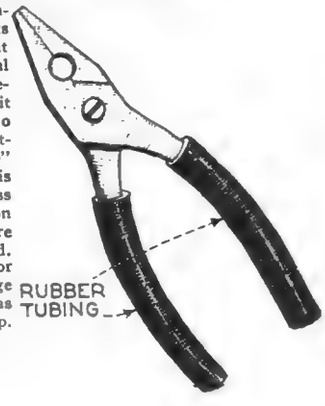
A bolt and nut may be inserted into the handle of an axe if the axe is driven considerably further than usual onto the handle. This will prevent accidents due to the head flying off.—H. M. Cohen.

EMERGENCY FUSE



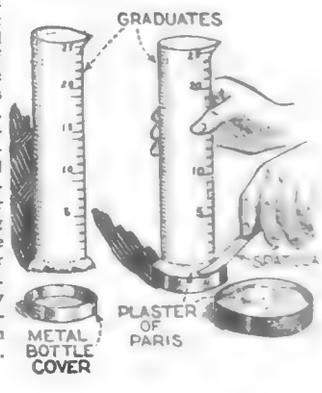
An emergency fuse may be improvised from a burnt out electric light bulb. The glass is broken away, and the heavier wires of the filament are twisted together, forming a link which is equivalent to that of a household circuit fuse. — Alfred Woods, Rep. No. 13.

SAFETY PLIERS

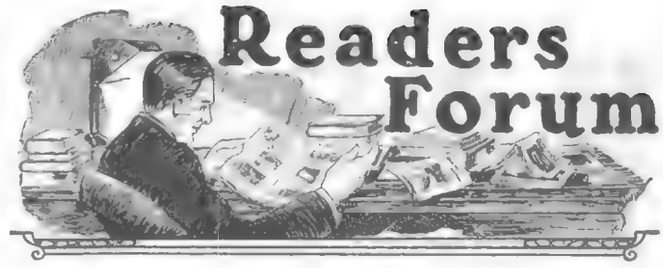


The experimenter who works to any extent with electrical circuits sometimes finds it necessary to make adjustments of "live" wires. This is unsafe, unless the precaution illustrated here is observed. Not safe for high-voltage lines.—Thomas Patella, Rep. No. 26,450.

REPAIRING SHATTERED GRADUATE



It quite often happens that the solid glass base of a graduate cylinder is broken, either by expansion under heat and sudden contraction or by knocking the base against other apparatus. A base may be improvised as shown here. — A. Caldarone.



SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor.—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

HAVE WE A SOUL?

Editor SCIENCE AND INVENTION:

Instead of speculating on whether or not the dead can be reunited, wouldn't it be more opportune if we were to turn deaf ears to the false exponents of our outgrown superstition (known as religion) and were to make an attempt to prove by scientific methods whether or not we really exist after death?

There is really no scientific basis for a belief in a soul, as religion advocated that theory, and religion will continue to, as long as it gives the clergy a hold on the individual, and incidentally, on his pocket book.

Now I'm not trying to start a rumpus with the religionists—far from it. I'm simply trying to present my argument in the only way I know—by showing that this belief in a soul is unscientific.

Well, science has investigated everything else pertaining to man without the aid of religion. Why not the soul? Why take the word of a number of so-called prophets we know nothing about? Who are not even mentioned in history? Who believed the earth was flat, and that the sun revolved around it? Who believed in witchcraft and devils? Who believed that the sick and insane were inhabited by devils? Who knew less about science than the modern school boy? Why?

Now I recently read an article in which the author claimed the cells in our bodies are immortal, and that death is simply the breaking up of the organism. Genuine science that.

Lets have more genuine science and coax this soul into a test-tube. Surely the men who are counting the electrons would have discovered the soul if it existed. Does it?

Just a word of praise for your publications. They're immense.

HARRY G. OWEN,
Chicago, Ill.

(Your statement to the effect that there is really no scientific basis for a soul may or may not be held, dependent on your own personal view. Most scientists will agree that there is something which disappears from this body immediately after death. You may call it a soul, the ego, the spirit or anything else you wish, proverbially it would be a "rose by any other name." The fact of the matter is that the body is exactly identical immediately after death with what it was before death. The brain has not disappeared, the cells are still there, movements may still be coördinated by stimulating the nerve endings by means of an electrical current or by heat or cold, reflexes may be absent or present a short time after death, depending on the nature of the reflexes and the heart may even be stimulated to beat again. The heart of animals for instance, can be removed from the bodies after the animals are dead and can be made to actually pump warm saline solutions for many hours. So what is it that is missing? What is lacking in the body after death and was present before death? Perhaps it is because we do not know, that we call that agency a soul. Scientists do know that the body decreases in weight immediately after death. This may be due to the volume of expired air, or may also be due to a certain amount of evaporated moisture or as some scientists would prefer to state, it may be the soul. This has not been proven. We can only conjecture at the cause of the decreased weight. The only reason that modern scientists call that indefinite "something" which disappears or which is lacking at the time of death, a soul, is because it was called that in more ancient times. We are not accepting the definition of the soul as given by some prophets, although we might just as well do so because their definitions are as good as any of ours. Your statement to the effect that death is merely the "breaking up of the organism" is to us representative of "painting the lily." To what organism are you referring? Nails and hair continue to grow after death. This would not indicate a breaking up of organism. Reflex actions and stimulated actions can be produced; this would seem to show that organism is present. Then what is meant by this term organism? Nerve cells are still present and are practically unchanged, the nerve endings are still in evidence and the anastomosis of the nerve is also to be found. What then is that something which most of us prefer to call the soul, whose departure has made from our living bodies a mass of inanimate flesh? What is that energy and where has it gone which is found in the brain of man? Scientists know that nothing can be lost in this universe. Nothing can be gained. Matter or energy is merely changed from one form to another. Where does the energy of the mind go when a truly brilliant character departs from this earth? Scientists are quite frank to admit that they don't know what the soul is. Even though you may choose to call it by any other name, there is something present in the living form which is entirely lacking when the scythe of death mows down the individual.—EDITOR)

SLIGHT FAULTS

Editor SCIENCE AND INVENTION:

This is neither an ultimatum nor a praise from my part, but my own poor, opinion, with the brain of a boy of 16.

Several people say they could never do without SCIENCE AND INVENTION Magazine. I don't believe this statement. What I do know is, that the reader of the SCIENCE AND INVENTION Magazine is always superior to his fellow friends.

AMAZING STORIES

IN OUR MARCH ISSUE:

THE GREEN SPLOTCHES, by T. S. Stribling. A perfect story for our pages must be really amazing and must be scientific. This story is, without a question, a classic of scientifiction, one of the most amazing tales it has ever been our good fortune to read.

UNDER THE KNIFE, by H. G. Wells. Here is an extraordinary imaginative story by the great author, a story of such audacity that you will read it breathlessly from start to finish. While gruesome to an extent, it is the weird experiences of the patient that stand out rather than the gruesomeness.

THE PEOPLE OF THE PIT, by A. Merritt. Here is an exceedingly clever story about intelligences which are absolutely incomprehensible to us—with almost invisible bodies floating through the air, yet possessing strange powers. A weird story that will remain with you long after you have read it.

THE HAMMERING MAN, by Edwin Balmer and William B. MacHarg. Here the psychological detective with the help of his sphygmograph, lays bare a crime a generation old, thus solving many weird and mysterious problems. You will enjoy this story even more than the preceding stories by these clever authors.

THE LAND THAT TIME FORGOT, by Edgar Rice Burroughs (Part II). If you think it is impossible to maintain a high pitch of exciting interest in telling of thrilling episodes and adventures, read the second instalment of this story. The author continues to keep you on edge in a most amazing manner.

There are two things I don't like about your magazine and policy: (1) The long time between the issues; and (2) The blue colored letter you return with unaccepted manuscripts. I don't think that the latter is just on your part. I guess it is, though, for the big'uns; but I don't feel it is right for us, small folks who are just beginning life. Instead of sending a blue letter (curse it) you could write us telling the article was old stuff, or no good, or any reason, so that we might get better in the future. Don't you think so?

I also see that while you boast printing only new stuff, you have printed an age old article which is known and written in every book, twice, once in May 1926 and again in August 1926. This is the "Arc Light" on page 55 of the May and 334 of August issue, both by Conrad Ruppert. I wonder if this is from the "Finesse" of your intelligence? Let all of 'em pass, I frankly admit that I did not like *Tarrano the Conqueror*, serial. The reason is, not that it is a bad story, but the bad point is that we forget every time where we left off and what was going on in the previous issue, so we must reread the previous issue again.

I think that for a short articled magazine like yours, short stories finishing in one issue would be best.

However, after all these slight faults SCIENCE AND INVENTION is the best scientific magazine on the market. Mr. H. Gernsback's editorial on the first page I like most of all.

By the way, don't you think you are printing too many airplane articles?

And last but not least, the Scientific Humor department prints dry jokes.

Wishing the best of success for a still better SCIENCE AND INVENTION Magazine.

G. NAZARETIAN,
Alexandria, Egypt.

(While we would like everyone to look at SCIENCE AND INVENTION *Magazine as being 100% perfect, we can well understand that it is far from that. Different opinions from different portions of the globe indicate that what pleases one individual will greatly displease another. It is impossible for any scientific publication to boast of publishing only new stuff. Whenever possible however, we try to use new material. The editors will not knowingly republish old material, unless that old material presents an entirely new viewpoint, or it is presented from a new angle.*

Originally the blue slips with rejected manuscripts were so marked that the editors could check the reason for the return of various manuscripts. Unfortunately, this condition entailed a much greater amount of work and when thousands of manuscripts were pouring in constantly, it made the method impractical. Each and every manuscript which arrives at the offices of this publication is considered carefully before it is rejected or accepted. If our readers would try to send material more in the class of that published in this journal, we could assure them that their manuscripts will be looked upon with a greater degree of favor.

In every issue of this publication, the synopsis of Tarrano The Conqueror appeared. In a very brief form the story told in the previous installments was again placed before the reader and served to refresh his memory. Many of our readers prefer to have an exceptional serial in SCIENCE AND INVENTION *Magazine than short stories claiming that they can get all the scientific short stories they want from* AMAZING STORIES *Magazine, another of our publications.*

The editor does not like to publish dry scientific jokes any more than the reader cares to read them, but what are you going to do when our contributors will not send in scientific jokes and when they do submit scientific jokes, a few of them are dry, and most of them are old? Let us hope that the influx of jokes will all be scientific and that they will all be very humorous.—EDITOR)

SHORT STORIES NOT NECESSARY.

Editor SCIENCE AND INVENTION:

In your note to Mr. Kissinger's letter you said that you would appreciate hearing from your readers about the short story, so here goes.

I think that if all of your serials are as good as *Tarrano The Conqueror*, a short story will not be necessary, especially since you are printing AMAZING STORIES.

JOHN BUDDHUE,
Milwaukee, Wis.

(Mr. Kissinger wanted to know why SCIENCE AND INVENTION *Magazine could not publish short stories in addition to the serial. We explained that most of our readers are satisfied with but one story in a scientific magazine, but we solicited the comments from other readers. This letter is typical of the many which we have received.*—EDITOR.)

FIVE DIMENSIONS

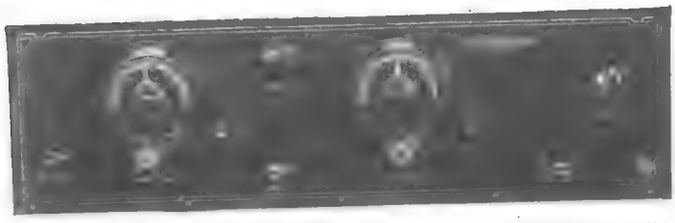
Reading the first installment of Ray Cummings' fine new serial, "Into The Fourth Dimension," has suggested a new line of thought to me, which I hope will prove interesting to the readers of SCIENCE AND INVENTION Magazine who get as much of a thrill out of the story as I did.

Speaking of the conception that time is the fourth dimension, the argument is that an object, besides having length, breadth, and thickness, must have duration, and that therefore time is as intrinsically necessary to the existence of an object, as are the three familiar dimensions. This is undoubtedly true, but does not necessarily prove that time is a dimension, for, dimension, in the strictest sense of the word, implies space. However, if we accept anything which is necessary to the existence of an object, as a dimension, then we must also accept location as a dimension, for an object might have length, breadth, thickness, and duration, and yet without location it could not exist unless it were infinite, and if it were, it could not be considered an object. However, if there were such a thing as an infinite object, still no definite section of it could exist without location, and if no section of it could exist, then it could not exist, for the whole is equal to all of its parts. Therefore, an infinite object, if it be considered an object, could not exist unless its parts; relative to each other, and the whole; had location, which leads us to the conclusion (following the concept that anything necessary to the existence of an object is a dimension) that there are five dimensions, viz.:

1. LENGTH, is the direction in which the object under consideration is extended the [illegible] distance.

(*Continued on page* 106)

The Power Six Receiver



The new Power Six receiver is a modification and improvement upon the circuit published in the April, 1926, issue of this magazine. The new set has been tested out and found highly selective, with good sensitivity and excellent tone quality.

IF you use the same high quality parts throughout, including high grade audio transformers, you should have a receiver that will not be surpassed in tone quality, selectivity and sensitivity. All the important features of construction are thoroughly covered by diagrams and instructions in this article. We have attempted to give you herewith all the details and suggestions which our experience with this circuit during the past two years has shown to be necessary to its best construction. You will be amply repaid for the care you employ in assembling your receiver. Its performance will be governed to a certain extent by the skill and judgment you employ in its construction.

While these instructions are as complete as possible, you will find upon reading them over that they are not as complicated as they might seem at first glance.

We suggest that the instructions be read over completely, in order that you obtain a general idea of the plan of construction before taking up the matter step by step.

The Power-Six Receiver employs three stages of tuned radio frequency amplification, a detector and two stages of audio frequency amplification.

STAGES

The detector tube is the fundamental unit of all receivers. If the antenna were connected to the detector coil and the phones placed in the plate circuit, signals could be tuned in, just as in a standard one-tube set. In order to make these signals louder two stages of audio frequency amplification are added. A jack is inserted in each stage to permit use of either one or two stages of audio amplification. To still further strengthen the signal and secure sharper selection, three stages of tuned radio frequency amplification are employed ahead of the detector. Each radio frequency stage and the detector requires a tuning condenser and coil; in all, four coils and four condensers. However, two condensers are attached to each shaft in order to simplify the tuning.

PREVENTING OSCILLATION

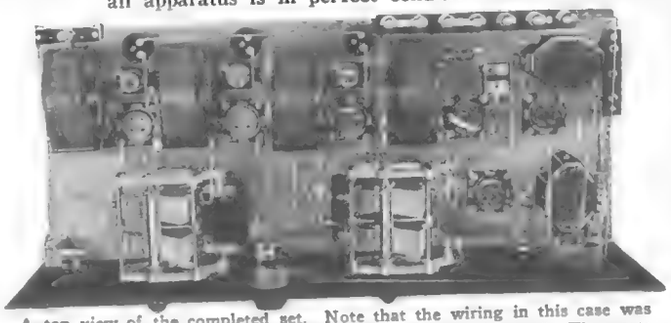
When the tuned radio frequency stages of a receiver are tuned to the same frequency, there is a tendency to oscillate. In this set oscillation is prevented by a separate counterphase circuit in each stage. This is a special feature covered by patents. Each counterphase circuit is permanently adjusted by means of a balancing condenser to suit the tube used. The 1500-ohm resistance in series with the grid of each tube is used to keep the set equally sensitive over the broadcast band. Normally, with the ordinary connections for transformer-coupled radio frequency amplification, there is a marked variation in the sensitivity of the set from the lower to the higher wavelengths. This is due mainly to the fact that the set tends to oscillate most readily at the higher frequencies (lower wavelengths). The 1500-ohm resistance in combination with the series-variable resistance of 500,000-ohms in the B-battery lead, tends to hold the amplification practically constant over the range of this receiver. The 500,000-ohm variable resistance is used to control volume.

Two degrees of antenna coupling are provided in order that the operator may adjust his set to the selectivity and sensitivity requirements of his own individual locality and antenna. This switch controls the amount of energy fed from the antenna into the set.

A "C" battery is used on both the radio frequency and audio frequency stages of this receiver. This materially lengthens the life of the B-batteries and improves the all around performance of the receiver.

BASEBOARD LAYOUT

Parts which mount on the baseboard should be placed according to photograph of baseboard, and small holes started for all mounting screws. All parts may now be mounted. Examine each carefully, making certain that all apparatus is in perfect condition before proceeding to wire. Mount the coils last. The first steps of wiring may be more easily accomplished by removing the panel from baseboard.



A top view of the completed set. Note that the wiring in this case was done with square bus bar, although other types may be used. The parts used in this set were furnished to us by the manufacturer, who provides them in kit form for the benefit of experimenters.

WIRING

In wiring the set, No. 14 tinned round bus wire should be used for best appearance and results. Acid fluxes or acid-core solder almost invariably result in corrosion and should be avoided by the amateur set builder. Rosin-core solder should be used throughout. The secret of good soldering is in using a well-tinned soldering iron which is kept sufficiently hot to vaporize the rosin and yet not hot enough to cause the rosin to carbonize. The tip of a dirty iron should be filed clean and tinned with a thin coating of solder. (Remember that it is almost impossible to solder two corroded surfaces—scape surfaces clean.) In soldering first touch the hot iron to the connection to be soldered and then touch the junction of the iron and connection with a piece of rosin core soldering wire. If the apparatus is clean and the iron at the right temperature the solder will flow on the joint and the rosin will pass off as vapor leaving a neat, clean connection.

Before wiring the jacks, spread the terminals as far apart as possible in order to eliminate the possibility of solder running in between the springs. Soldering lugs should be used throughout the set in making connections to all pieces of apparatus on which binding posts are used. This makes possible a much neater appearance and eliminates the possibility of heating the terminals too hot and thereby disconnecting wires which may be soldered to them from the inside. Terminals are furnished with the kit for this purpose. Either binding posts or some type of plug-in connections may be used to provide the battery connections.

"C" BATTERY

It is preferable to place the "C" battery inside the cabinet or immediately outside if there is not sufficient room. Either flexible leads or separate posts may be used to provide for these connections.

CHECK WIRING CAREFULLY

Before connecting the batteries to the completed set, carefully check over all connections and then in order to be sure that no mistake has been made which would burn out the tubes, make the following test. Connect one side of the "A" battery to the terminal minus "B" and then, with the tubes in their sockets and the filament switch turned on, connect the other side of the "A" battery to each of the plus "B" binding posts or connections, one at a time. The tubes should not light; if by any chance they do light, carefully check over the circuit and locate the short or wrong connection between the "A" and "B" circuit before proceeding any further.

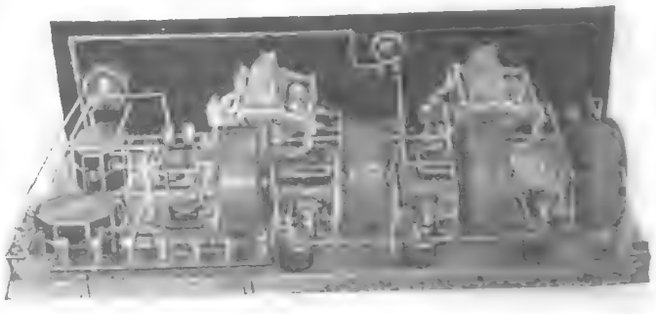
The set is now ready for preliminary tests and adjustments of the balancing condensers. Connect all the batteries properly and insert one of the tubes. Turn switch on—if tube lights properly insert all tubes. With the tubes turned on, the antenna and speaker connected, you should be able to tune in stations provided all connections have been properly made and no defective apparatus has been used.

It is well to test all the condensers and coils before and after the set is hooked up. To do this connect one end of the phones to a battery of four to six volts, and connect the other end to one of the binding posts of the coil or condenser. The other terminal of the battery should now be touched to the other binding post.

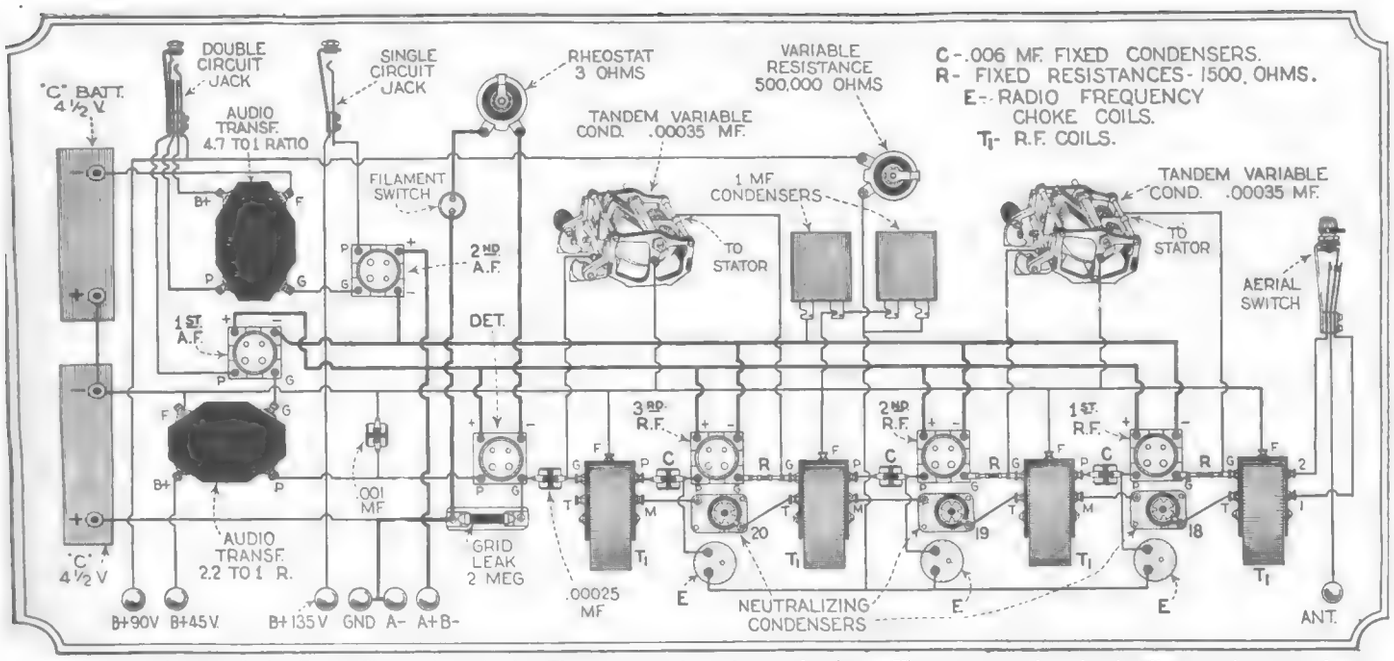
SOLDERING SUGGESTIONS

Do not use acids for soldering. Use rosin core solder or dissolve a small amount of powdered rosin in alcohol to the consistency of a paste, and apply light coating to joint. Clean all parts thoroughly by scraping if they are not already tinned.

Clean the point of soldering copper by fil-



A view from the rear of the Power Six receiver. The small, round cylinders in front of the toroidal coils, are radio frequency chokes. Directly behind these are the balancing condensers for neutralizing the radio frequency stages. At the left are the two audio frequency transformers, embodying a new type of design, which improves reproducton considerably. The condensers are arranged in gangs.



A picture diagram of the Power Six receiver circuit. The apparatus is arranged in approximately the position each component occupies in the completed set. The gang condensers, resistance units, two switches, and jacks are mounted on the panel, all the other apparatus being fastened to the wooden base. The constants given in the diagram above are those used by the manufacturer in the kit set, and reference to this diagram and the one given below should furnish the experimenter with enough information to enable him to assemble the set from the kit or odd parts.

ing. Rub point with solder and salammoniac or soldering acid to secure a clean coating of solder. Soldering copper must always be hot enough to melt solder instantly. Solder connections by picking up a drop of solder on the point of copper and touching the copper to point of contact just sufficiently long to flow the solder thoroughly into point.

The essentials of soldering are: First, a clean thoroughly tinned point; second, a clean or tinned contact, with a small amount of rosin flux, and third, a hot copper. The copper must not be hot enough to burn the solder coating off the point.

Do not attempt to rush or hurry wiring. Careful and thorough work will insure immediate results, while hurried or slipshod work will destroy your apparatus, and make best results impossible. Cleanliness is of utmost importance. Do not permit so-called non-acid soldering pastes or flux to spread on apparatus. Do not apply too much heat to screws or terminal posts, or you may melt the soldered connections from inside of post; a hot iron quickly applied will avoid this danger.

ADJUSTMENT OF BALANCING CONDENSERS

Adjust all balancing condensers so that the "piston" of each is about halfway down in the glass cylinder. Tune in a station of moderate volume to exact resonance, that is, to exact tuning using trimmers—see "Tuning."

In the April, 1926, issue of SCIENCE AND INVENTION *magazine we published an article on the design and construction of a six-tube radio-frequency set, which is supplied in kit form to experimenters who desire to assemble a receiving set of high efficiency at a moderate cost. Many of our readers built this set, called the "Counterphase," and from the testimony of our correspondence it would seem that the set is even more satisfactory than anticipated. The designers of the original Counterphase set have recently announced the completion of an improved modification of this set, which is also to be supplied in kit form to those who desire to build it up at home.*

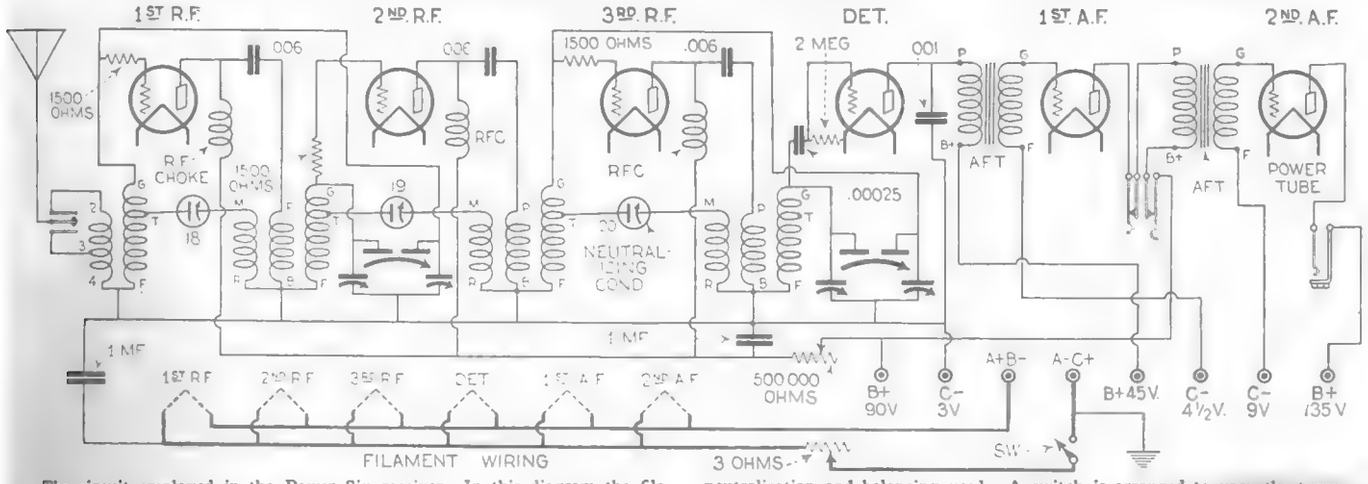
We have tested the new "Power Six" receiver after assembly in our own laboratory and have found it highly selective and comparable in results to any of the commercially manufactured tuned radio-frequency sets now on the market. On the accompanying pages, you will find complete instructions, with photographs and diagram, which will enable you to construct this receiver and wire it within the space of three or four hours of pleasant work.

Adjust volume control to greatest volume without oscillation. That is, greatest volume giving a clear signal and no whistle or beat when dial is rotated back and forth across signal. Disconnect either +A or —A filament connection to socket of tube No. 3 (the third R.F. tube): The signal should still be heard.

Now turn adjustment screw of the third balancing condenser No. 20 carefully and note that signal becomes weaker or disappears at a certain adjustment of it—this point is near the correct setting. Now retune right hand dial for loudest signal. Also rotate "trimmer" condenser to exact resonance. Again adjust balancing condenser to the setting which gives weakest signal or at which signal disappears. If signal remains weak or disappears over a setting of several turns, adjust to the middle of this weak or silent band. This setting is the proper permanent adjustment for this balancer. Replace the filament connection to tube No. 3. Retune the signal carefully using "trimmers."

Remove either +A or —A filament connection to socket of tube No. 2 and determine setting of the second balancing condenser No. 19 exactly as before. Retune both dials carefully before making final adjustment balancer. Signal may remain weak or disappear over a band of one or more turns of

(*Continued on page* 1067)



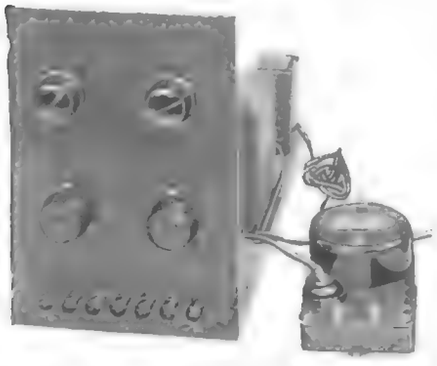
The circuit employed in the Power Six receiver. In this diagram the filament wiring is indicated separately, to make the wiring job easier. Note the way that the trimming condensers are arranged, also the method of neutralization and balancing used. A switch is arranged to vary the turns of wire in the antenna circuit for greater or less coupling, [illegible] is used to control all the tubes, no fine variation being

An A-B and C Battery Eliminator

The Unit Described Supplies "B" and "C" Current and Furnishes a Source for Experimentation With "A" Elimination

By A. P. PECK, Assoc, I.R.E.

THERE is no question about it, but that the "B" battery eliminator is here to stay as an integral part of radio. True, it will never entirely replace the "B" battery, because there are thousands of homes unequipped with electric light. However, there are so many other



Front view of the complete eliminator. The automatic relay for the control of the A.C. supply and the trickle charger is at the right of the unit.

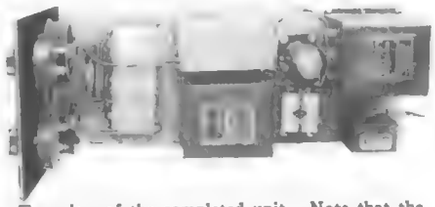
thousands that are so provided, that the "B" battery eliminator has made a permanent place for itself in the scheme of radio as it is today.

With the coming of the "B" battery eliminator, there also came an increase in the number of tubes employed in receivers. No longer was there the trouble of run down "B" batteries. Then came power amplifiers with tubes such as the UX 171 and the UX 210. Here more trouble was experienced because the eliminators that were available would not supply sufficient current to operate these tubes satisfactorily, and furthermore, a standard "B" battery had to be purchased anyway as it had to be used for supplying the grid bias to the power amplifier. Now we have with us the Raytheon BH tube,* a jack and connect the antenna and ground. Set double wave rectifier that will handle up to 85 milliamperes at 350 volts, and which provides the logical solution for the current supply to a power amplifier.

The writer has done considerable experimental work with this new type of tube and has found it to be a tube of exceptional characteristics. One of the greatest advantages and one that cannot be stressed too heavily because of its importance, is that the voltage drop through the tube does not vary when the load is changed. In other words, the only variable feature in a "B" eliminator using the type BH tube is the voltage regulation of the transformers. With a good transformer, the voltage supply to the various tubes in the receiver will be constant whether only 15 milliamperes or 85 are being drawn from the circuit. Furthermore, there is so much current available with this new tube, that with proper transformers, choke coils and filter condensers, there is the option of employing the rectified and filtered current for the operation of tubes of the UX 199 type with the filaments connected in series. You will undoubtedly hear more of this at an early date. For the present moment we will concern ourselves only with the "B" and "C" battery elimination feature.

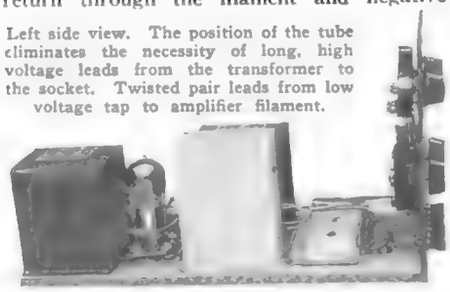
The writer does not wish to convey the impression that all of the "C" batteries are eliminated with this unit. This is not correct, as a 4½ to 9 volt "C" battery must be used for biasing the first or the first and second audio amplifiers, as the case may be. However, this particular arrangement does eliminate the high voltage biasing battery of 40 to 45 volts, which is necessary for the correct operation of a tube of the UX 171 type. This bias voltage is obtained in what we consider to be a rather unique method. A variable resistor is connected from the negative "B" post to another binding post which also connects to the negative out-put side of the rectifier and filter circuit. The voltage drop across this resistor becomes the biasing voltage for the power amplifier tube. This particular resistance is designated by R2 in the diagram shown in Fig. 1. The value of it will be found in the list of parts. In certain "A" elimination possibilities no "C" battery at all is necessary.

Further reference to the diagram in Fig. 1 will show that a potentiometer is used across the secondary transformer winding which supplies the current to the filament of the power amplifier tube. This potentio-



Top view of the completed unit. Note that the circuit breaker is mounted in an upright position.

meter is an absolute necessity, and it must not be slighted. It is in the circuit for the purpose of balancing the alternating current supply and eliminating any possibility of hum, which might be present if the grid return through the filament and negative



Left side view. The position of the tube eliminates the necessity of long, high voltage leads from the transformer to the socket. Twisted pair leads from low voltage tap to amplifier filament.

"B" wires were to connect directly to one side of the filament supply winding. The adjustment of this potentiometer is not critical or difficult. It is merely set to the position of least hum, which will be about midway between the two end terminals, and it is left in that position.

The variable "B" voltages for the detector and radio frequency amplifier are obtained by means of the variable resistances R and R3. These should be of a well made type such as those shown in the illustrations, and must be ones that will not change in value according to any rise in temperature which may be generated by the surge of the "B" battery current. These variabe resistances and also that controlling the "C" battery biasing voltage, are rather critical and must be adjusted very carefully if the best of results are to be obtained. In order to arrive at the proper adjustment, a milliammeter "A" in Fig. 1 is a necessity. When the "C' battery voltage is correct for the "B" voltage that is being applied to the audio frequency amplifying tubes, the needle of the meter "A" will not show a very great fluctuation with changes in signal strength. When the resistance, R2, is not correctly adjusted, the needle will show violent fluctuation either up or down, according to the value of the resistance, R2.

Since it is possible that those who are interested in this particular type of eliminator, may at some time desire to experiment with an "A" eliminator, it is suggested that a milliammeter of some standard make be obtained. This meter should have a full scale of from 0 to 100 milliamperes. This will take care of all work which may be done at a later date with "A" eliminators.

Since the maximum "B" voltage delivered by an eliminator of this nature is somewhat high for the operation of the first stage audio frequency amplifier, it is suggested that the plate circuit of this latter mentioned tube be connected to the binding post marked "Plus B Intermediate." This same point will also supply the voltage for the radio frequency amplifier tubes. Then the maximum "B" voltage may be applied to the last tube power amplifier. In case three stages of audio frequency amplification such as resistance coupled or one transformer and two choke coil coupled are used, the "Plus B Intermediate" voltage should be applied to the plates of the first two audio tubes, leaving the "Plus B Maximum" voltage for application to the last or power amplifier tube.

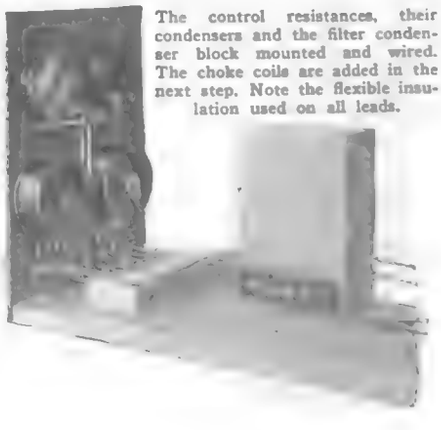
In the particular eliminator which the writer designed and constructed and which is shown in the various photographs accompanying this article, a special high voltage transformer whose secondary windings are indicated by S and S1 in Fig. 1 was employed.

The transformer used in the writer's unit had three secondary windings, one supplying in excess of 300 volts, and second the 5.5 volts for the operation of the filament of a UX 171 tube. There is also a third winding which is not used in this particular unit and which supplies 7.5 volts for heating the filament of a power amplifier tube of the UX 210 type. This of course, will be employed instead of the 5.5 volt winding when the UX 210 tube is used as the power amplifier.

The choke coils, CH and CH1, are, in the apparatus used, incorporated in a single housing and provided with convenient terminals for connecting in the filter circuit.

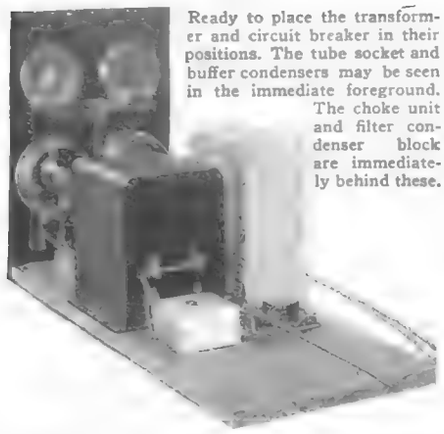
The filter condensers C2, C3 and C4 are housed in a block of the familiar type. This block has four terminals, one common, one connected to a 6-mf. condenser, and the other two connected to two 4-mf. condensers. This completes the filter system which is incorporated in only two units, thereby greatly simplifying the wiring over the older type of layout wherein separate condensers and two choke coils had to be employed.

The condensers C5, C6 and C7 have a



The control resistances, their condensers and the filter condenser block mounted and wired. The choke coils are added in the next step. Note the flexible insulation used on all leads.

*Schickerling or other filament-less tube is adaptable.



Ready to place the transformer and circuit breaker in their positions. The tube socket and buffer condensers may be seen in the immediate foreground. The choke unit and filter condenser block are immediately behind these.

capacity of 1-mf., and also assist in the filtering action. Therefore they should be of a high grade type capable of withstanding the maximum voltage found in the eliminator unit.

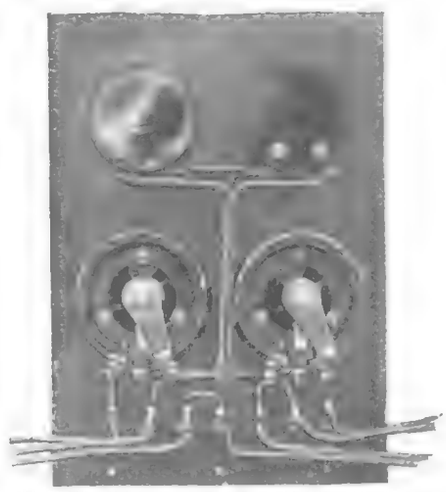
The writer believes that the layout for apparatus shown in the various photographs is about the simplest and most compact that can be employed. The baseboard is long and narrow, thereby adapting itself in an excellent manner to incorporation in a receiver that is already mounted in a console cabinet. This unit will easily fit into the battery cabinet of practically any console that is on the market today. It will be noted that the milliammeter mentioned above was not incorporated in the unit because it is a handy little instrument that is always in demand in the experimental laboratory. Therefore, it can best be mounted on a small block and provided with two flexible leads so that it will be instantly available for test purposes either on this eliminator or on any other apparatus upon which work is being done. Furthermore, these meters are rather expensive, and the average experimenter does not have more than one available.

When approaching the assembly of a comparatively compact unit of this type, it is advisable to work out the procedure beforehand. The writer found that it was best, for ease in wiring, to mount the parts on the base in the order of use in progress of wiring, rather than to mount them all in position and then proceed. The photographs illustrate the method very well. The control panel was first drilled and the variable resistances and the binding posts mounted on it. These were wired as shown in the rear view of the panel. This was then fastened to the base with wood screws and the 1-mf. condensers and the fixed resistor mounted in place. The wires from the panel were extended to these parts and soldered in their proper places. Then the filter condenser block was mounted and wired. The chokes in their unit case came next: then the buffer condensers and the socket and finally the transformer and the automatic cut-out.

Because of the fact that an eliminator of this or any other type has wires carrying high voltages, it is not advisable to use bare wire in hooking it up. Rather, rubber covered wire, about number 16 in size should be employed.

It is obvious that trouble can arise if connections from the eliminator to the set become mixed up. Therefore, it is strongly recommended that engraved binding posts only be used. They should be of the type from which the heads cannot be removed because if these are not employed, there is a possibility that some of the tops may be taken off when attaching wires, and then become mixed up when replaced. It is little precautions of this nature that make it possible to avoid disastrous accidents when working with power apparatus.

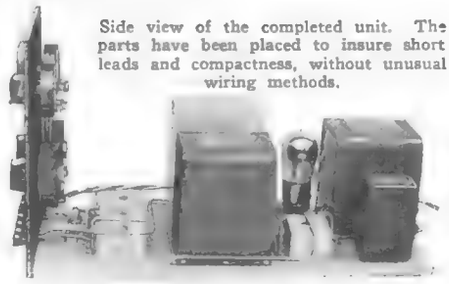
A word must be said about the automatic circuit breaker indicated by "X" in the diagram in Fig. 1. The incorporation of this little unit in any battery eliminator is an advantageous feature. It does away with the necessity of protective fuses, and at the same time can be used as a manually operated switch. It has the advantages of both the circuit breaker and the switch. Set to release at 3 amperes current flow, it will immediately open the AC circuit if anything should go wrong in the eliminator. Thus it not only prevents any accident in the circuit, but also protects the fuses in the house lighting circuit. When this circuit breaker flips open due to an overload, investigate immediately and when the trouble has been detected and fixed, it is only necessary to press a small button on the side of the circuit-breaker and resume operation. Pressing the button on the opposite side of this little instrument causes it to actuate a switch and open the circuit of the AC line.



Back view of the control panel. The values of the variable resistances are given in the text. The binding posts provide for all the connections to the set.

A list of the parts used in the writer's eliminator follows. Those who desire more specific information or a list of the names of the manufacturers will be supplied with such upon request.

X—Circuit Breaker.



Side view of the completed unit. The parts have been placed to insure short leads and compactness, without unusual wiring methods.

P, S & SI—Special in-put transformer.
C & C1—1-mf. buffer condensers.
RT—Type BH Raytheon tube.
CH & CH1—Double choke coils in single housing.
C2, C3 & C4—4-mf., 4-mf. and 6-mf. respectively, in single block.
R—0- to 100,000-ohm variable resistor.
R1—10,000-ohm fixed resistor.
R2—400-ohm potentiometer.
R3—0- to 50,000-ohm resistor.
R4—400-ohm potentiometer.
C5, C6 & C7—.1-mf. fixed condensers.

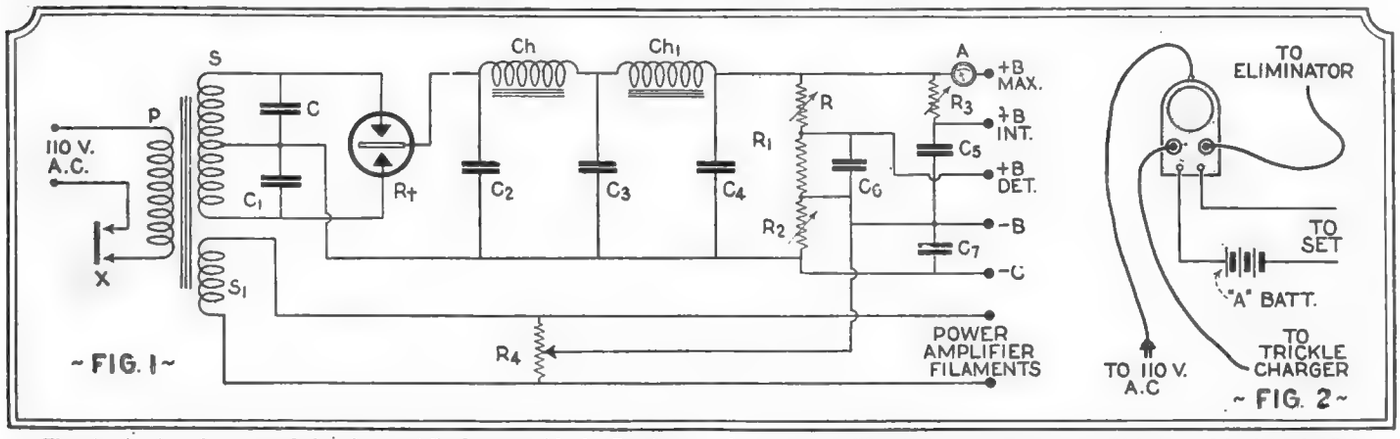
The other parts necessary for the construction of this eliminator are a baseboard, a small panel for mounting the various instruments, any type of cabinet desired for housing the unit, a quantity of No. 14 or No. 16 soft rubber covered wire, and the necessary machine screws, wood screws, lugs and solder.

It must be noted in the construction of this eliminator, that all of the instruments are shielded from each other by the metal cases. These cases should all be connected together and connected to the negative "B" battery wire.

In the photograph of the front panel of the eliminator, a relay device is shown. This is for the purpose of automatically controlling the "B" eliminator and a trickle charger for the storage battery. With an instrument of this type, no special switches are necessary. It is hooked up as shown in Fig. 2 and when the filament switch on the set is closed, the relay connects the eliminator to the AC line and disconnects the trickle charger. When the regular filament switch is opened, the eliminator is disconnected from the line and the trickle charger goes into action.

TOOL LIST

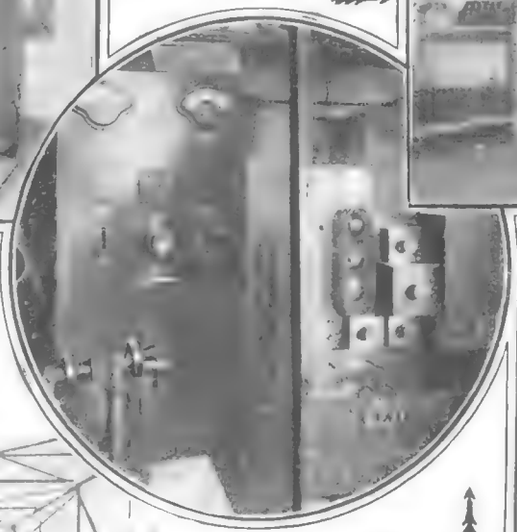
Screw Drivers, several sizes. Reamer for panel holes. Pliers, several kinds. Hand Drill. Twist Drills, several sizes. Hammer. Center-Punch. Scriber. Hack-Saw. Soldering iron (Electric preferred.) Wire Solder, self-fluxing or other kind. Files, several.



The circuit given here was designed essentially for use with the Raytheon tube, but any one of the similar types on the market, such as the Schickerling, may be employed if desired. The circuit is standard except for the power amplifier filament arrangement, which is explained in detail in the text of this article. High resistance voltmeters are needed in testing this or similar types of eliminators for output.

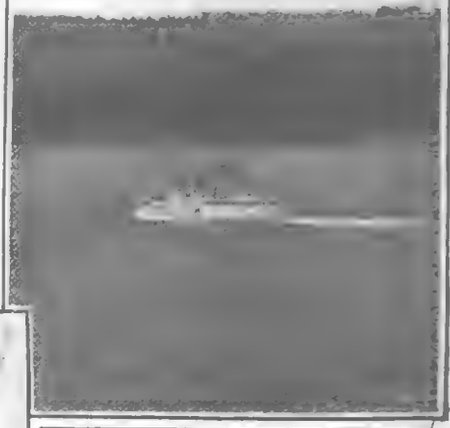
WRNY's New Transmitting Station

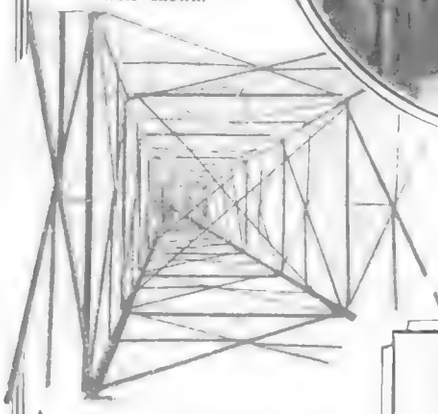
The remote-control station shown here, in interior and exterior views, is located at Coytesville, N. J., opposite the upper end of Manhattan Island. Programs are received by land-line from the studio in New York. At the right is the receiver for detecting "SOS" calls. This watch is always maintained during transmission periods.



One of WRNY's operators is shown making a preliminary adjustment upon the transmitter. The wavelength of this is varied by the condenser and variometer controls shown.

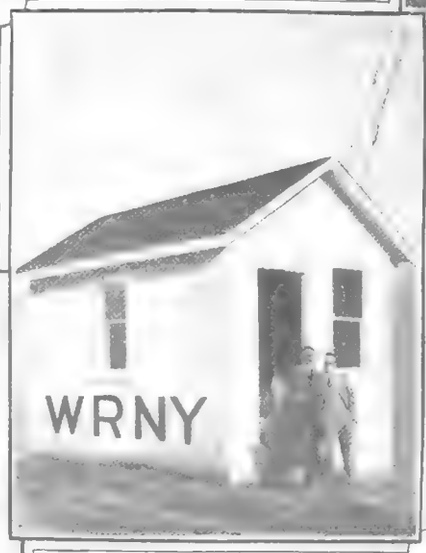
Above, at the left, appears the control panel for the motor-generator set, which furnishes power for the transmitting tubes; while at the right is a close-up view of the speech-amplifier panel.

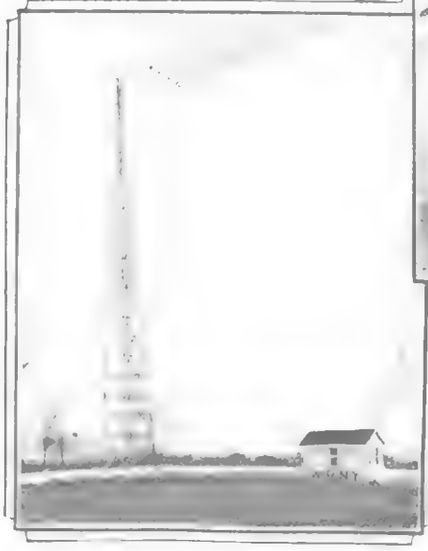




This steel spider web is what you would see on looking up the interior of one of WRNY's masts, which are 127 feet high; they are of the latest type of construction and braced to withstand high winds, because of their exposed position on top of the Palisades.

The WRNY antenna as it appears from the New York side of the Hudson River. The cliffs are about 425 feet high, thus bringing the aerial to about 550 feet above the water level.





Above, in the doorway of the "shack," is the station force of WRNY. The other two views of the antenna and station, at the right and left, show the manner of suspension of the flat-top aerial and the lead-in. This antenna installation is the highest one in the New York Metropolitan district, and some remarkable reception has been reported by foreign listeners since the change.

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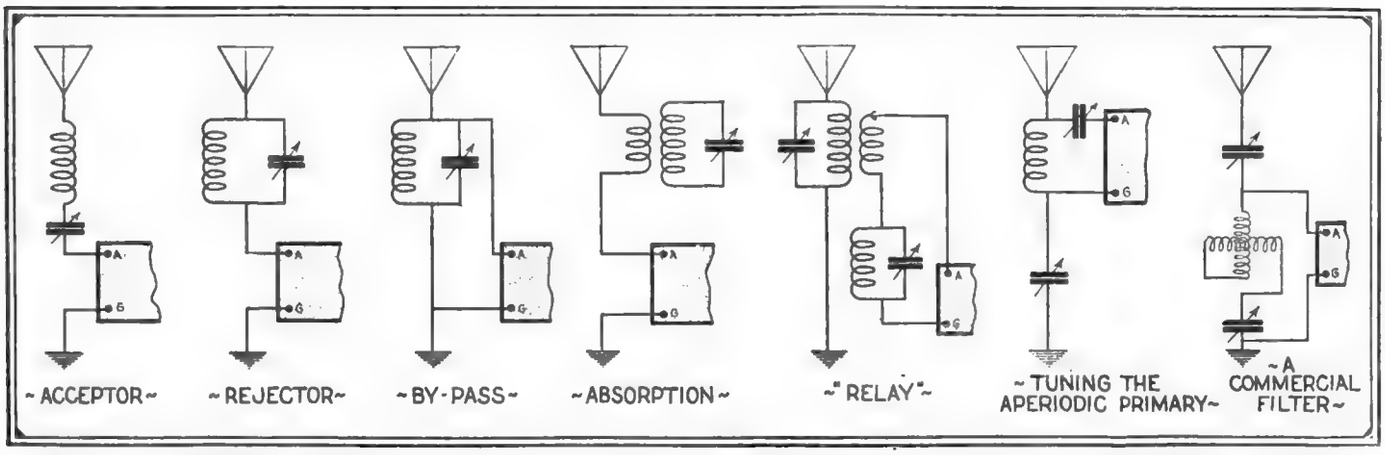


The seven circuits illustrated in the diagram above cover the basic principles used in the design of interference eliminators or wavetraps. It will be found that each type is best suited to a condition, and a judicious selection is possible only after a reasonable amount of experimentation. In most cases the absorption filter will be found sufficiently practical for use in all but the most congested localities.

ANOTHER B BATTERY TRANSMITTER

(527) C. Ferber, Santa Monica, Calif., asks:

Q. 1. Will you please recommend a radio telephone circuit using receiving tubes and dry cell B batteries?

A. 1. You will find on this page a circuit diagram of a type of transmitter which has been tested and found very satisfactory for the medium wavelengths. We do not recommend this circuit for short-wave work, and we find a modified Reinartz circuit to be best for the new short-wave experiments. You will notice that the transmitter uses two of the 210 type tubes, which are rated at about 7½ watts output. You will find these tubes of about equal efficiency to the 5 watt tubes formerly used. In the diagram, the modulation transformer, M, may be any one of the commercial makes, or it may be simply a telephone induction coil connected as shown. The choke coil indicated at X need not necessarily have a value of exactly 6 henries, but it should not be smaller than this figure. The oscillator system, consisting of Coil L_2, and Condenser C_2, of the simplest design practical, and the constants of these parts depend entirely upon the wavelength range over which the set is intended to operate. The same is true of the coil L_1, and the variable condenser C_1, used to tune the antenna circuit. As the circuit is arranged here, a tap on the C battery is taken for the microphone circuit. You may find that an electromagnetic pick-up will work better than a carbon microphone in this case. Such a pick-up may be improvised by connecting a cone loud talker through an audio-frequency amplifier to the input side of a modulation transformer, such as that used in this diagram.

ELIMINATOR TRANSFORMER

(528) Mr. Edwin Thompson of Wichita, Kansas, asks:

Q. 1. For the dimensions of form and winding required for B-battery eliminator, Transformers and Filter chokes.

A. 1. Core built up of L-strips in shape of square. Outside dimensions 2½"x3½", inside ¼"x1¼". Winding on one leg. Core ⅞-inch square.

Primary 1140 turns No. 28 enamelled copper wire. Tap at 910 turns.

Secondary 4200 turns No. 31 enamelled copper wire. Tap at center.

Wound in layers with .0015 in. paper between layers.

Electrostatic shield between primary and secondary (.005 copper).

Core material is Apolo special electrical steel No. 29 gauge. Laminations are assembled to give staggered air gaps.

Primary d.c. resistance is approximately 25 ohms.

Secondary d.c. resistance is approximately 300 ohms. total.

Two halves of secondary should be balanced for voltage output at full load output within two per cent.

Choke Coils. Core ⅛ in. square.

5800 turns No. 28 enameled copper wire on each coil.

D. C. resistance of each coil is approximately 190 ohms.

Laminations are assembled to form a butt joint, with .003 in. insulated air gap.

Two choke coils required for each eliminator circuit.

B-BATTERY ELIMINATOR

(529) E. B. Lupton, San Francisco, Calif., asks:

Q. 1. For technical information concerning the "B" battery eliminator described in the May, 1925 issue of this publication.

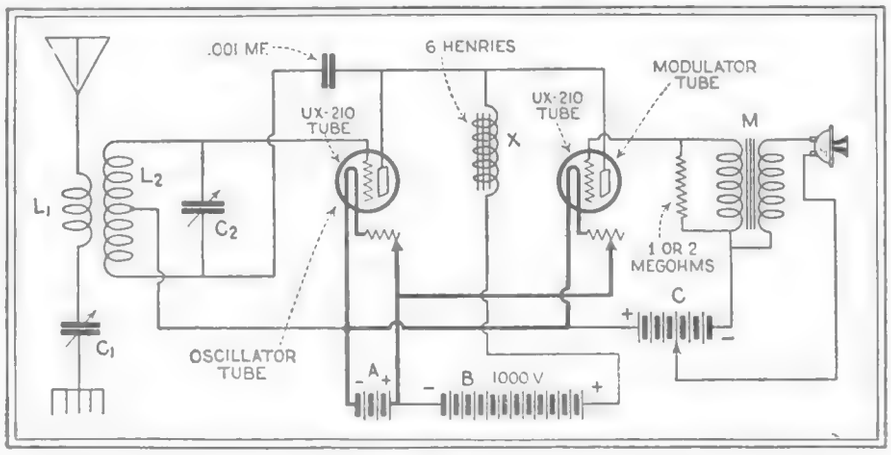
A. 1. The following data is correct for the various instruments to be used in the construction of the "B" battery eliminator that you mention.

The core of the transformer is constructed of silicon steel strips .014 inches thick by 1½ inches wide. The outside dimensions of the core are 5 inches square and the legs should be built up to 1½ inches high.

The 110 volt primary consists of 384 turns of No. 22 D.C.C. wire, wound 48 turns per layer in 8 layers. The secondary consists of 980 turns of No. 26 D.C.C wire, wound 65 turns per layer in 15 layers A center tap is brought out at the 490th turn to be connected as shown in the diagram in this magazine. In the above data, space is allowed at the ends of the windings for supports for the same. Both coils should be well insulated from the core and may be wound on opposite legs.

The electrodes of the rectifier are made of lead and aluminum plates as indicated in the article. They may be 1 inch wide by 3 inches long with an additonal length allowed for projection above the surface of the liquid. The latter may consist of a saturated solution of ammonium phosphate or borax in water. The surface should be covered with a ½-inch thick film of mineral or paraffin oil to prevent evaporation. The electrodes should be thoroughly sandpapered before being placed in the solution.

The 2-mf. condenser may be purchased from any radio or telephone supply house or possibly from your local telephone company.



Compact low power transmitters seem to interest a large number of our readers, so we are publishing another diagram suitable for this type of work above. Note that a B battery voltage of 1000 is used. This is the maximum for the 210 type tube, but less may be used if desired.

INTERFERENCE ELIMINATION

(530) Q. 1. Mr. A. L. Brown, New York, N. Y., writes us for information regarding the elimination of interference in the congested districts of the metropolitan area.

A. 1. At the head of this page is shown a series of diagrams illustrating the best approved methods of eliminating undesired signals. The first diagram shows an "Acceptor" circuit, where the auxiliary coil and condenser are tuned to the wanted signal, thus tending to raise it above the interference level. The second coil and condenser in parallel "reject" the undesired signal by trapping it and preventing it from energizing the antenna circuit of the set. The third circuit by passes the undesired signal to the ground, while the primary circuit of the set may tap off any desired frequency. The fourth, "Absorption" circuit, utilizes the principle of the fourth circuit in the Cockaday set, in vogue a year or so ago. The fifth is a "Relay" circuit, where the antenna is tuned and an intermediate trap is used between the receiver and antenna circuit. The sixth circuit illustrates one of the most efficient methods of tuning a set which is equipped with an aperiodic primary. The seventh circuit is that employed by the designers of a commercial filter called the "Filterola." The makers claim that the signal is amplified, with the usual elimination of undesired frequencies. For the broadcast wave lengths the coil and condenser used in these trap circuits may conform in each case to the following specifications: The coil, 55 turns of No. 26 double silk covered wire on a 3-inch form; the condenser, .00035 or .0005 mfd. low-loss variable. The better the construction of the coil and condenser, the better the results to be expected.

RECTIFIER SOLUTION

(531) Q. 1. Mr. George Smith, Philadelphia, Pa., inquires for the proper method of preparing the solution for an electrolytic rectifier of the lead-aluminum type.

A. 1. The solution used in the type of cell you mention is generally specified as a "Saturated Solution of Borax in Water." In the first place, a "saturated" solution is one in which the greatest possible amount of solid material has been dissolved. In this case it is done as follows: A quantity of water is heated to a temperature somewhat below boiling. To this water is added borax (obtainable at any grocery store) until the excess of borax begins to collect at the bottom of the container in the form of a white powder. The solution must be stirred constantly to insure the dissolving of as much borax as possible. The solution should be allowed to stand over a period of time necessary to dissolve as much borax as possible. This gives a saturated solution. After all the solid has settled, the liquid should be siphoned or decanted off and used in the rectifier cell. Due to evaporation, the liquid should be replaced

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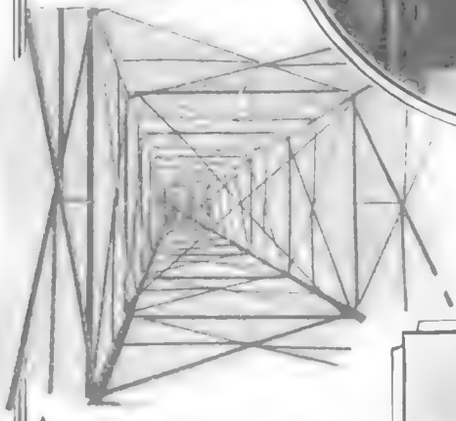

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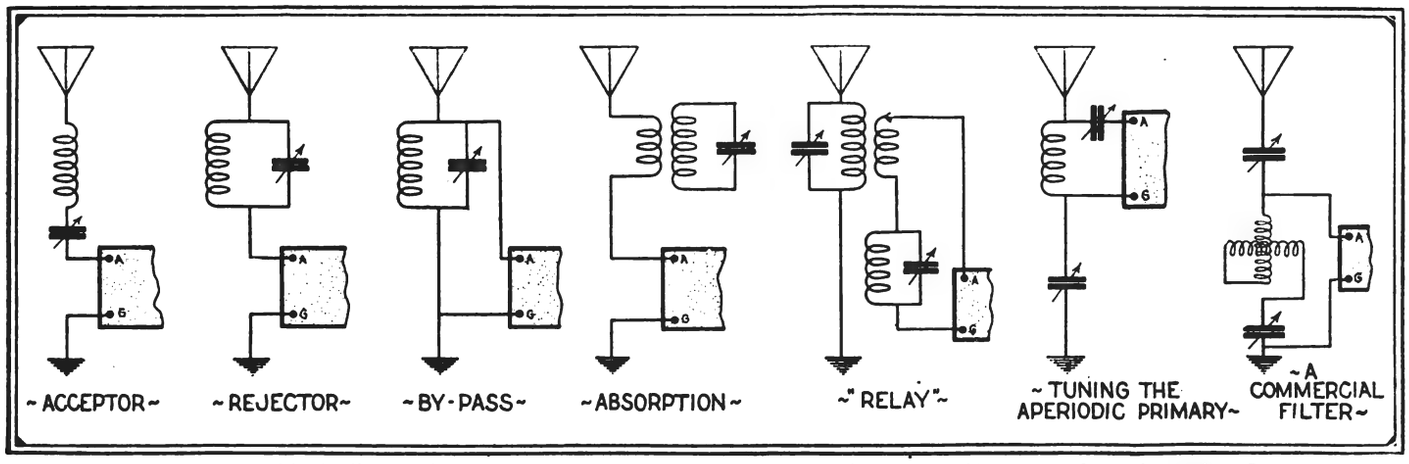
RADIO ORACLE

In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.



The seven circuits illustrated in the diagram above cover the basic principles used in the design of interference eliminators or wavetraps. It will be found that each type is best suited to a condition, and a judicious selection is possible only after a reasonable amount of experimentation. In most cases the absorption filter will be found sufficiently practical for use in all but the most congested localities.

ANOTHER B BATTERY TRANSMITTER

(527) C. Ferber, Santa Monica, Calif., asks:

Q. 1. Will you please recommend a radio telephone circuit using receiving tubes and dry cell B batteries?

A. 1. You will find on this page a circuit diagram of a type of transmitter which has been tested and found very satisfactory for the medium wavelengths. We do not recommend this circuit for short-wave work, and we find a modified Reinartz circuit to be best for the new short-wave experiments. You will notice that the transmitter uses two of the 210 type tubes, which are rated at about 7½ watts output. You will find these tubes of about equal efficiency to the 5 watt tubes formerly used. In the diagram, the modulation transformer, M, may be any one of the commercial makes, or it may be simply a telephone induction coil connected as shown. The choke coil indicated at X need not necessarily have a value of exactly 6 henries, but it should not be smaller than this figure. The oscillator system, consisting of Coil L_2, and Condenser C_2, of the simplest design practical, and the constants of these parts depend entirely upon the wavelength range over which the set is intended to operate. The same is true of the coil L_1, and the variable condenser C_1, used to tune the antenna circuit. As the circuit is arranged here, a tap on the C battery is taken for the microphone circuit. You may find that an electromagnetic pick-up will work better than a carbon microphone in this case. Such a pick-up may be improvised by connecting a cone loud talker through an audio-frequency amplifier to the input side of a modulation transformer, such as that used in this diagram.

ELIMINATOR TRANSFORMER

(528) Mr. Edwin Thompson of Wichita, Kansas, asks:

Q. 1. For the dimensions of form and winding required for B-battery eliminator, Transformers and Filter chokes.

A. 1. Core built up of L-strips in shape of square. Outside dimensions 2½"x3½", inside ¾"x1¾". Winding on one leg. Core ⅞-inch square.

Primary 1140 turns No. 28 enamelled copper wire. Tap at 910 turns.

Secondary 4200 turns No. 31 enamelled copper wire. Tap at center.

Wound in layers with .0015 in. paper between layers.

Electrostatic shield between primary and secondary (.005 copper).

Core material is Apolo special electrical steel No. 29 gauge. Laminations are assembled to give staggered air gaps.

Primary d.c. resistance is approximately 25 ohms.

Secondary d.c. resistance is approximately 300 ohms. total.

Two halves of secondary should be balanced for voltage output at full load output within two per cent.

Choke Coils. Core ⅞ in. square.

5800 turns No. 28 enameled copper wire on each coil.

D. C. resistance of each coil is approximately 190 ohms.

Laminations are assembled to form a butt joint, with .003 in. insulated air gap.

Two choke coils required for each eliminator circuit.

B-BATTERY ELIMINATOR

(529) E. B. Lupton, San Francisco, Calif., asks:

Q. 1. For technical information concerning the "B" battery eliminator described in the May, 1925 issue of this publication.

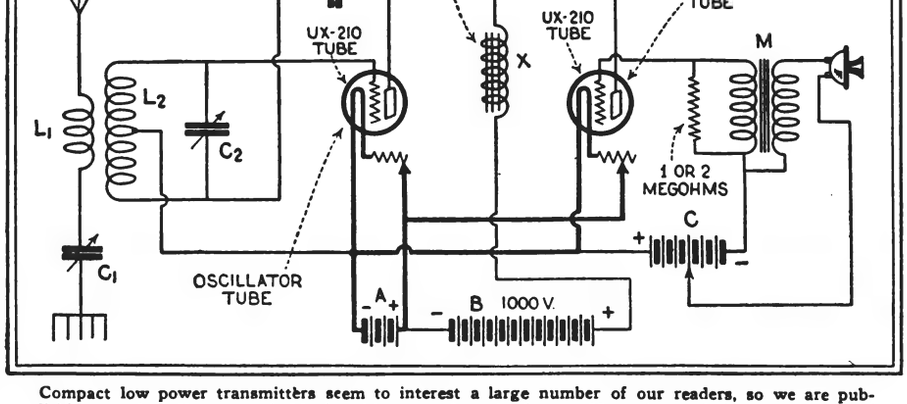
A. 1. The following data is correct for the various instruments to be used in the construction of the "B" battery eliminator that you mention.

The core of the transformer is constructed of silicon steel strips .014 inches thick by 1½ inches wide. The outside dimensions of the core are 5 inches square and the legs should be built up to 1½ inches high.

The 110 volt primary consists of 384 turns of No. 22 D.C.C. wire, wound 48 turns per layer in 8 layers. The secondary consists of 980 turns of No. 26 D.C.C wire, wound 65 turns per layer in 15 layers A center tap is brought out at the 490th turn to be connected as shown in the diagram in this magazine. In the above data, space is allowed at the ends of the windings for supports for the same. Both coils should be well insulated from the core and may be wound on opposite legs.

The electrodes of the rectifier are made of lead and aluminum plates as indicated in the article. They may be 1 inch wide by 3 inches long with an additonal length allowed for projection above the surface of the liquid. The latter may consist of a saturated solution of ammonium phosphate or borax in water. The surface should be covered with a ⅛-inch thick film of mineral or paraffin oil to prevent evaporation. The electrodes should be thoroughly sandpapered before being placed in the solution.

The 2-mf. condenser may be purchased from any radio or telephone supply house or possibly from your local telephone company.



Compact low power transmitters seem to interest a large number of our readers, so we are publishing another diagram suitable for this type of work above. Note that a B battery voltage of 1000 is used. This is the maximum for the 210 type tube, but less may be used if desired.

INTERFERENCE ELIMINATION

(530) Q. 1. Mr. A. L. Brown, New York, N. Y., writes us for information regarding the elimination of interference in the congested districts of the metropolitan area.

A. 1. At the head of this page is shown a series of diagrams illustrating the best approved methods of eliminating undesired signals. The first diagram shows an "Acceptor" circuit, where the auxiliary coil and condenser are tuned to the wanted signal, thus tending to raise it above the interference level. The second coil and condenser in parallel "reject" the undesired signal by trapping it and preventing it from energizing the antenna circuit of the set. The third circuit by passes the undesired signal to the ground, while the primary circuit of the set may tap off any desired frequency. The fourth, "Absorption" circuit, utilizes the principle of the fourth circuit in the Cockaday set, in vogue a year or so ago. The fifth is a "Relay" circuit, where the antenna is tuned and an intermediate trap is used between the receiver and antenna circuit. The sixth circuit illustrates one of the most efficient methods of tuning a set which is equipped with an aperiodic primary. The seventh circuit is that employed by the designers of a commercial filter called the "Filterola." The makers claim that the signal is amplified, with the usual elimination of undesired frequencies. For the broadcast wave lengths the coil and condenser used in these trap circuits may conform in each case to the following specifications: The coil, 55 turns of No. 26 double silk covered wire on a 3-inch form; the condenser, .00035 or .0005 mfd. low-loss variable. The better the construction of the coil and condenser, the better the results to be expected.

RECTIFIER SOLUTION

(531) Q. 1. Mr. George Smith, Philadelphia, Pa., inquires for the proper method of preparing the solution for an electrolytic rectifier of the lead-aluminum type.

A. 1. The solution used in the type of cell you mention is generally specified as a "Saturated Solution of Borax in Water." In the first place, a "saturated" solution is one in which the greatest possible amount of solid material has been dissolved. In this case it is done as follows: A quantity of water is heated to a temperature somewhat below boiling. To this water is added borax (obtainable at any grocery store) until the excess of borax begins to collect at the bottom of the container in the form of a white powder. The solution must be stirred constantly to insure the dissolving of as much borax as possible. The solution should be allowed to stand over a period of time necessary to dissolve as much borax as possible. This gives a saturated solution. After all the solid has settled, the liquid should be siphoned or decanted off and used in the rectifier cell. Due to evaporation, the liquid will have to be replaced occasionally.

Scientific Humor

NOT DUNNINGER

JIM: "Wasn't it funny last night the way that magician fired the pieces of your watch from his pistol and then found the whole watch in my pocket."

WILL: "No, it wasn't funny. He hasn't given my watch back yet."—*John H. Spicer.*

HORSE SENSE

VISITOR: "What are you drawing? Old top."

ARTIST: "A horse and buggy."

VISITOR: "I see the horse but where's the buggy?"

ARTIST: "Oh well! The horse has to draw that."—*E. L. Bruce.*

ECONOMY PLUS

VICTIM: "You've pulled three teeth! I only wanted one pulled."

DENTIST: "Yes, I kno-o-o-w. You see, we gave you a bit too much gas and it would have been a shame to have wasted it."—*Robert W. Heaney.*

FENDERS NEEDED

SLUSH: "Walking near the curb this kind of weather is risky business."

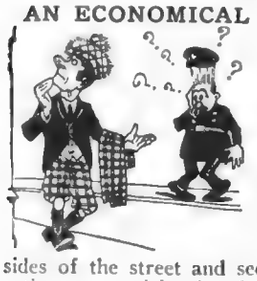
SLOSH: "Yes, you have to be constantly on your mudguard!"—*Henry A. Courtney.*

A FISHY GROWTH

TOMMY: "Do fish grow very fast?"

BILLY: "I should say! Father caught one once and it grows about six inches every time he mentions it."—*Erne Benn.*

AN ECONOMICAL SCOTCHMAN



Recently a Scotchman was walking through Detroit carrying a pair of pants on his arm. A policeman, well known for his alertness, noticed him scanning the buildings on both sides of the street and seeing the individual acting so suspiciously, the policeman called, "What are you prowling around here for, with those pants on your arm?"

The Scotchman replied indignantly, "I'm looking for the DETROIT FREE PRESS."—*Harold F. Reed.*

BOILING BOYLES

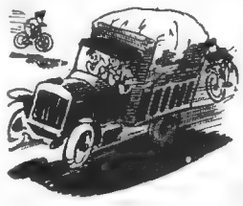
SCIENCE TEACHER: "We have some dumb Doras in our Chemistry Class."

PRINCIPAL: "Why do you say that?"

SCIENCE TEACHER: "One girl is so dumb that she thinks Boyle's Law is a new method of cooking."—*Russell D. Miller.*

First Prize $3.00

DAMP AND DANGEROUS



Mrs. Pryde told the cook that her husband had gone to Canada to study hydrodynamics.

"And what may that be?" asked the honest and ignorant cook.

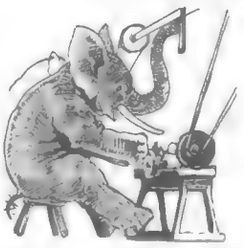
"It is the science of moving liquids," explained Mrs. Pryde.

"Sure and there's many a good man in jail today for knowin' too much about that science," asserted the cook.—*H. M. Strong.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

THEY MIGHT TRY THEM ON LEAGUE BASEBALLS



JACK: "Do you know that 16,842 elephants were used to make billiard balls last year?"

SMACK: "You don't say! My Gosh! Isn't it wonderful how such big beasts can be taught such exacting work?"—*Max Hammerman.*

TAP IT AND SEE!

A stranger in town was inquiring about various things, when he spied a sign reading: "Tap and Die Factory."

"What could possibly be manufactured there?" he asked.

The Village Wit replied, "Why Dynamite, of course."

A TWISTED PROPOSITION

PEGGY: "See that fellow going down the street? Well he cleaned up a big fortune in crooked dough."

REGGIE: "What, Bootlegging?"

PEGGY: "No, pretzel manufacturing. *Joseph Wallace.*

BASS TONES

ANSWERS TO CORRESPONDENCE EDITOR: "Here's a fellow who wants to know what instrument produces foot notes."

SPORT EDITOR: "Tell him a shoe horn."—*James Gray.*

REACTION

"They poured acid down the villain's throat,
They poured it down his face,
But he neutralized it to a salt,
The villain was so base."—*Jack Weiland.*

ELEMENT-ARY

CHEMISTRY PROF: "Henry, can you tell the class what Barium is?"

HENRY (sleepily): "Sure, Barium is an undertaker's motto."—*Clelland J. Ball.*

START YE?

The Professor had been talking to the Botany class on the manufacture and storage of foods in plants.

"Now, Mr. Green," he asked, "can you tell me the name of a common plant that stores starch, and where it is stored?"

Freshman Green awake: "Why—er—A laundry plant, sir, stores starch in collars and cuffs."

To make a long story short, the Professor collared the boy, gave him a cuff, and said. "Watch out how you starch ya (start your) funny stuff."—*Henry Baker.*

MATHEMATICALLY SPEAKING

SECOND COOK: "Did you expect me to scrape those fish you just disemboweled?"

FIRST COOK: "Sure, they are drawn to scale."—*James Gray.*

SCIENTY SIMON, SCIENTIST!

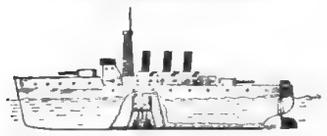
CHARLIE BIPP PROMISED TO GIVE ME HIS NEW RADIO HOOK-UP IF I
AROUND HIS HOUSE.
BEWARE! MEASLES
IT'S ME KID SISTER GERTIE AND I CANT COME OUT! --
BUT JUST WAIT HERE A MINUTE..
HERE'S THE HOOK-UP! -- SCRIBBLE IT ON A PAGE FROM GERTIE'S COPY-BOOK!
SCIENCE LESSON NO. 4
DISEASES LIKE SCARLET FEVER AND MEASLES ARE HIGHLY CONTAGIOUS OR "CATCHING" -- THE GERMS ARE OFTEN CARRIED TO THE HEALTHY PERSON WHEN HE TOUCHES SOME ART ICLE USED BY THE SICK ONE
MEASLES

LATEST PATENTS

FLOOR LAMP DESIGN

1,606,354 issued to J. N. Fillion. The lamp design illustrated above is arranged so that a series of shutters may be opened or closed to permit more or less light to be emitted from the lamps placed within the body of the bird. This control of light makes proper illumination for reading purposes very easy to obtain. The patent does not limit the design of the shade to that shown here.

TOY STEAMBOAT



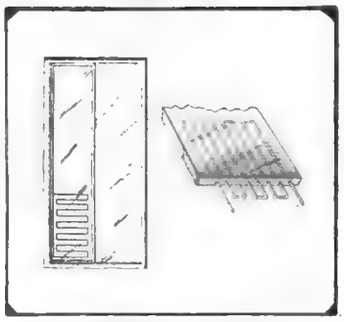
1,607,670 issued to L. Gennusa. This patent covers the design of a toy which should appeal to every child with mechanical inclinations. Steam, generated by heating water in a small boiler over a solidified alcohol flame, is caused to propel the boat forward by reacting against the water at the stern of the boat.

ILLUMINATED SCREW DRIVER

1,603,985 issued to J. Rosenberg. The screw driver illustrated above is arranged with two separately controllable lights, one of which illuminates the area about the tip of the screw driver, the other light being in the end of the handle for use in lighting up the field of operation. The battery is contained in the handle.

SLEET-PROOF WINDSHIELD

1,606,526 issued to W. D. Graham. A coil of wire moulded into the glass of an automobile windshield, to heat it so that sleet and snow will not collect, but will be melted so that the driver's vision will not be interfered with.

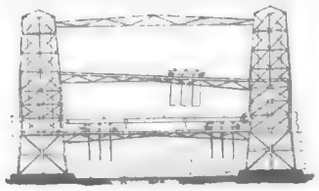


EXERCISING APPARATUS

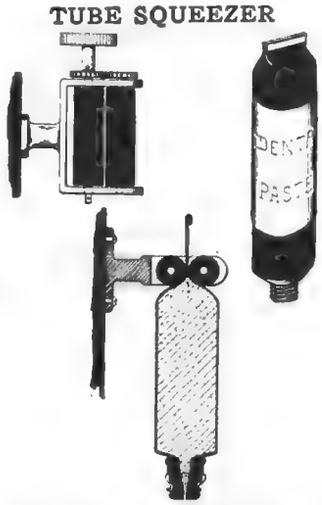
1,585,748 issued to A. C. Wendelken. For those who are sufficiently interested in physical culture to turn on the radio for the 6:30 A. M. setting up exercises, the device illustrated below should prove a boon. The victim is expected to stand on a table which is free to move in any direction that fancy dictates, while he hangs to the loops above him and gyrates ecstatically in all directions. If some such apparatus as this is used, space is conserved.

WATER POWER GENERATOR

1,608,373 issued to N. Dell. A very clever idea for utilizing the power of running water to generate electrical energy is illustrated below. A number of cars are caused to move back and forth across the stream by reversing vanes suspended in the water.



TUBE SQUEEZER

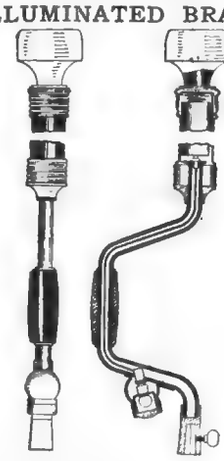


1,605,914 issued to M. R. Bishop. There are a number of devices filling this need now on the market, but it is hard to remove the emptied tube from all of them. This is the first one we have seen which seems to be practical.

TRICK MOVIES

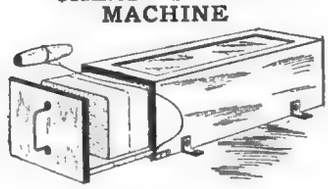
1,606,483 issued to E. Schufftan. The effects obtained by clever photographers are a source of wonder to most movie fans. Here is one of the methods used in a well-known European studio to produce a special effect by photographing the images of a painting and a full-sized scene in one mirror.

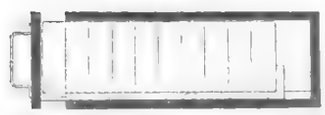
ILLUMINATED BRACE



1,606,986 issued to J. Rosenberg. The brace illustrated at the end of the foregoing column has an electric light fastened to one side of the arm so that the bit will be illuminated when drilling in dark corners. It is sometimes quite desirable to have the working space well lit up to prevent making errors in drilling holes which must register.

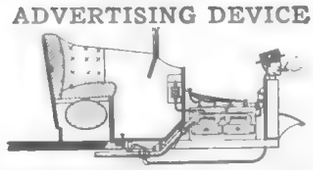
CHEESE SLICING MACHINE





1,595,097 issued to C. H. Howell. This device is adaptable to use in cutting butter, cheese or any similar material. A wire is fastened to one side of the base, and is caused to cut the material by pulling upon the handle at the free end. Perhaps this method could also be used for cutting bread.

ADVERTISING DEVICE

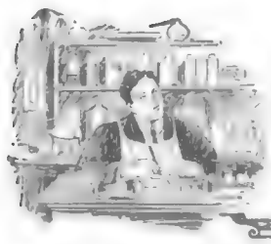


1,607,336 issued to G. H. Conners. This patent takes the form of a head or other more or less decorative device used as a radiator cap ornament, with a pipe or imitation cigar connected to the exhaust pipe. The idea, of course, is to attract the attention to a slogan.

COFFEE MAKER

1,604,058 issued to H. Mager. The drawing above illustrates a machine for preparing coffee from the bean. The coffee is first ground in an inner cylinder, roasted by dry heat obtained from electrical coils, and then boiled or percolated in an outer chamber. The vapors given off in the roasting process are introduced into the boiling chamber, where they are combined with the liquid coffee to add an aroma otherwise lacking.

NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information. —EDITOR.



THE ORACLE

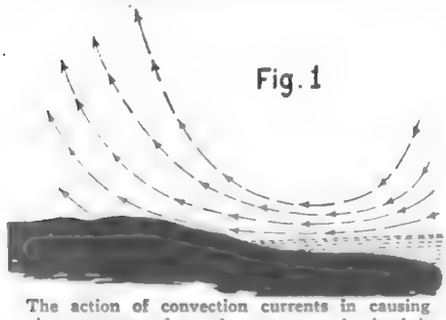
The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

LAKE AND SEA BREEZES

(2157) Mr. Theodore Weaver, Chapel Hill, N. C., asks:

Q. 1. Please explain the cause and effect of lake and sea breezes.



The action of convection currents in causing air movements from the water to the land is illustrated by the drawing above.

A. 1. To account for these breezes the causes for the movement of air need to be recalled. One cause is the difference in temperature. When air is expanded by heating, it becomes lighter; that is, a cubic foot of it weighs less, because the amount of air that occupied a cubic foot of space before it was heated has expanded. If next to the warm air there is a quantity of colder and heavier air, this colder air will tend to flow in under the warm air and lift it up. This is what happens in the vicinity of a stove or radiator, where the cool air is continually flowing toward the stove, where it is warmed and in turn displaced by the other cool air, thus making a continuous current.

The same thing occurs along a shore. In summer the land is much hotter than the water, at least while the sun is shining. Like the stove, the land heats the air which is over it until this air becomes so light that the heavier air above the water begins to flow out over the land, crowding the warm air upward (see Fig. 1). The air from the water becomes heated as it flows across the land, and rises as it is displaced by more air from the lake. Thus there is a continuous flow of air across the shore line from water to land as long as the land is hotter than the water, excepting when local breezes are counteracted by stronger and more general movements of the air. The breeze gets well started about the middle of the forenoon, the time the land ordinarily becomes heated. During the night the land may be cooler than in the daytime; sometimes so much cooler than the water that the air flows from the land to the water, but this land breeze is much less noticeable than the water breeze.

The more rapid heating of the land is due, first, to the fact that it is not transparent. All the heat of the sun is received on the surface of the land, and the upper few inches are very rapidly heated, while the lower parts receive the heat slowly. Indeed, so slowly is heat transmitted to the deeper layers of the soil that at a depth of a comparatively few feet the temperature does not change either in summer or winter. On the other hand, the sun's rays penetrate into the water to a considerable depth (see Fig. 2) the exact distance depending on the clearness of the water. If the water is clouded by sediment, the rays of the sun do not penetrate very far. A second reason is that since a greater proportion of the sun's rays are reflected from the water than from the land, much of the heat is reflected also and does not actually enter the water. A third reason lies in the fact that water moves easily. Waves and currents mix the warm surface waters with the cool deeper layers, thus scattering the heat widely. For these reasons, although as much heat will be received upon a square foot of water as of land, the water is not heated so highly.

The fourth and most important reason is found in the effect of a given amount of heat upon different substances. If a kettle of water and a flatiron are placed on the kitchen range at the same time, the iron will be heated more rapidly than the water. If a pound of iron and a pound of water are placed on the stove and exposed equally to the heating surface, it will be found after a short time that the iron is much hotter than the water. The same amount of heat has much less effect on the water than on the iron, so far as raising its temperature is concerned. The amount of heat which will warm a pound of iron 1° C. will warm a pound of water only 0.11 of 1° C.; that is, it takes over nine times as much heat to produce a given temperature in the same weight of water. There are so many kinds of soil that if we were to use soil instead of iron for this experiment, the results would very vary widely.

The land cools more rapidly than the water. As it is necessary to put more heat into water than into land in order to raise its temperature a given amount, so the water gives off this larger amount of heat when it cools. Furthermore, as water cools it gives off its heat slowly, and since much of the heat is in the deeper parts of the water, it is not readily given off. We may therefore expect that any body of water will be cooler in summer than the neighboring land, at least during the day time and while the sun is shining, and that breezes from water to land will be common. During the winter the water may remain much warmer than the land.

REPORTER

Science and Invention

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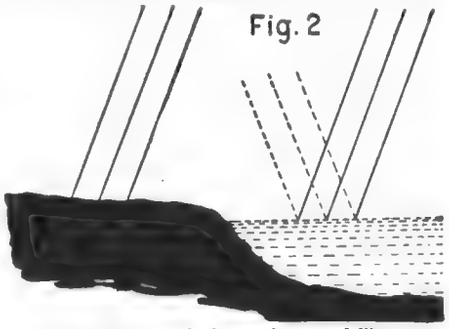


A great portion of the sun's rays falling on water is reflected at the surface and causes but little heating.

MAXIM SILENCER

(2158) Joe E. Tell, Eagle Pass, Texas, asks:

Q. 1. Please give an explanation of the operation of a Maxim silencer to be used on small fire-arms.

A. 1. In general, the principle underlying the operation of a Maxim silencer such as used for rifles or revolvers is as follows. The device consists of a series of circular plates through the centers of which holes are pierced, large enough to allow the passage of the bullet. There are also other holes pierced through the peripheries of the rings and the plates are so located that they impart a whirling motion to the gases. The latter are then retarded in their progress and do not burst from the barrel of the gun with the rapidity that they do when no silencer is used. In other words, after the bullet has reached a certain place in its travel, that is, some point in the silencer itself, the explosive force of the gases is reduced by means of this whirling motion and therefore the noise that would otherwise be generated is also reduced.

RECLAIMING OIL

(2159) James J. Williams, Dunlap, Mo., asks:

Q. 1. Can you give me a method of reclaiming crank-case oil by the use of sodium silicate?

A. 1. Relative to your query in regard to details of the process of the reclamation of crank-case oil by sodium silicate, we would refer you to a well-known American concern, who are the largest producers of sodium silicate (water glass) in this country, and who have a particularly developed brand of silicate for use in reclamation. Name furnished on request.

We understand they have recently issued a pamphlet on the process and its details. In general the oil is mixed with the silicate and heated to 80 deg. Cent. and agitated. The particles of impurities, sludge, etc., mix with the silicate solution and settle with it to the bottom, leaving the clean oil at the top.

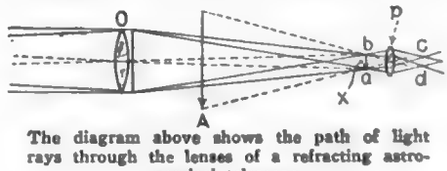
THE TELESCOPE

(2160) John S. Hart, Brooklyn, N. Y., asks:

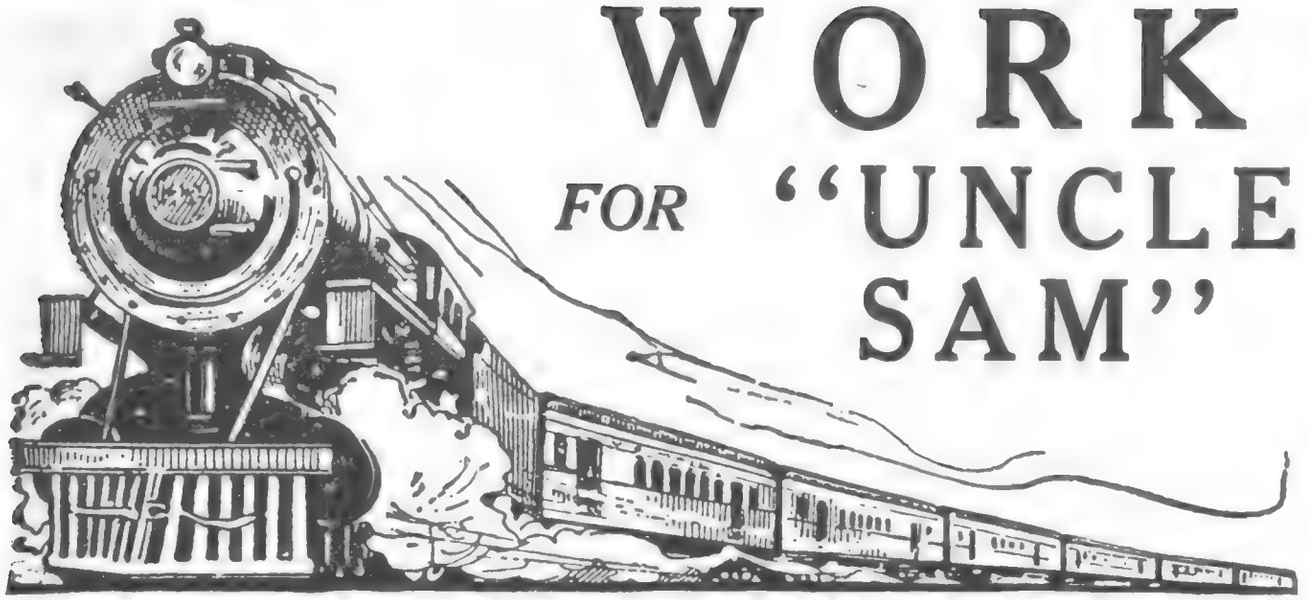
Q. 1. Please explain by means of a diagram, the action of a refracting astronomical telescope in magnifying distant images.

A. 1. The essential part of a telescope comprises two lenses,—a long-focus, large diameter achromatic convex lens, turned toward the object in view and therefore known as the objective, O, and a smaller convex lens, p, (or a set of lenses) called the eyepiece. The object here viewed is supposed to be an arrow, very far away, but so large that in spite of distance it subtends an angle of only a degree or so. If this conception seems too artificial, we may think of the point of the arrow as representing one star, the butt another. Wavefronts are not indicated, but lines are drawn to show the course, through the instrument, of the cone of light from each end of the arrow. Dotted lines show the undeviated rays for each lens.

A *real inverted image* of the object is formed in the focal plane of the objective, from which the waves continue on, diverging from this image exactly as if it were a material object, except that the light is limited to a comparatively small cone. This light falls upon the eyepiece, which forms with it a second image, really an image of an image. Since the rays that form any point of the first image are limited to the cone that comes through the objective, it may well happen that the undeviated ray drawn from this point through the center of the eyepiece lies outside the cone and therefore does not exist as a real ray. But the position of the second image must certainly be independent of the diameter of the objective, and therefore we are at liberty in such a case to find that position by drawing fictitious undeviated rays just as if they really did exist. The figure is drawn for such a case. The position of the second image depends of course upon the location of the eyepiece, which is mounted so that the observer can slide it at will through a short distance toward or away from the objective. Most observers place it so that the first image lies a little within its principal focus. Then the second image, the one which the eye sees, is virtual, still inverted, and on the same side as the first image, but farther away. This is shown by A in the figure. If the principal focus were placed just at the real image *ab*, as it is sometimes done by persons of far-sighted or normal vision, A would be thrown back to infinity, like the original object, but would still subtend a much greater angle than the latter.



The diagram above shows the path of light rays through the lenses of a refracting astronomical telescope.



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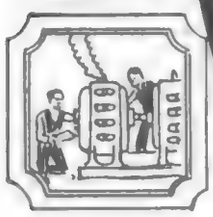

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Into the Fourth Dimension

BY RAY CUMMINGS

(*Continued from page* 1005)

of a placid, measured Time—the delay seemed dangerous. He was impatient; anxious to do something. But there was nothing which of himself he could do; and Thone was an Intelligence very keen. Will decided that upon Thone he must rely.

They went back to the home globe, to rest and to wait for my possible arrival. Will in a way was glad of the inactivity, for he remembered that of Thone's plans he knew almost nothing. He would learn all he could; and with something definitely arranged, they could act to better purpose.

Will felt the pangs of hunger. They brought a glowing brazier wherein something smouldered. He ate—inhaled, there is no word for it. Satisfied his pangs; and drank of the silver mist which came flowing into the globe at a word of command. . . . And slept; lost consciousness, to find himself in blackness with Time wholly gone.

But still I did not come back to the Big-City. There were times when with Thone, Will journeyed about the city streets, gazing at this strange life. He saw thought-

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TUNE IN ON WRNY

workers, as I had seen them in Brutar's encampment. Saw the water being created; saw the thought-matter moulded and spun into new globes—moulded to all the diverse purposes of this Ego-life.

He slept again; several times; and ministered to the slight wants of his tenuous body. A great length of time seemed passing; and still I did not arrive.

There were many talks that Will had with Thone. Ahla and Bee were generally there, sitting or reclining in silence as befitted those of their sex.

Sex? It was interesting to Will. The creation of the individual Ego of this strange realm, so different an existence, and yet in fundamental conception so like his own. Already he believed that the same Creator governed both. With strange ways that we mortals so little understand, over all the realms, the states of existence, the Universes that possibly could exist—only one Creator held sway. The Thought-Divine; there could be but One.

Will said, "You once spoke, Thone, of yourself as Ahla's parent. And the necessity of the Divine Thought to the creation of Ego life. Will you explain that? In our world we have two sexes. Have you also?"

"Yes," said Thone. "In the higher forms of life—we humans, as you would say—there are, like yours, two sexes. Call me a man—and Ahla a woman. The difference is one of mental capacity; mental qualities, inherent perhaps to the Soul-Ego. I call it

(*Continued on page* 1044)

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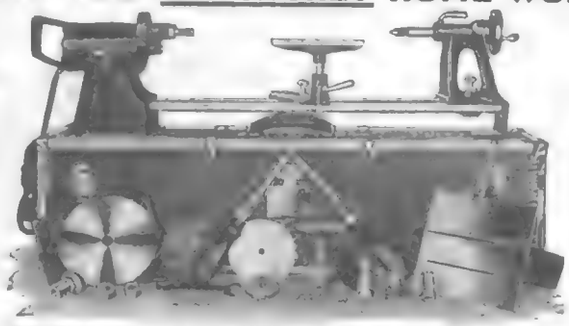

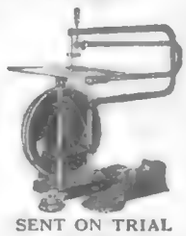

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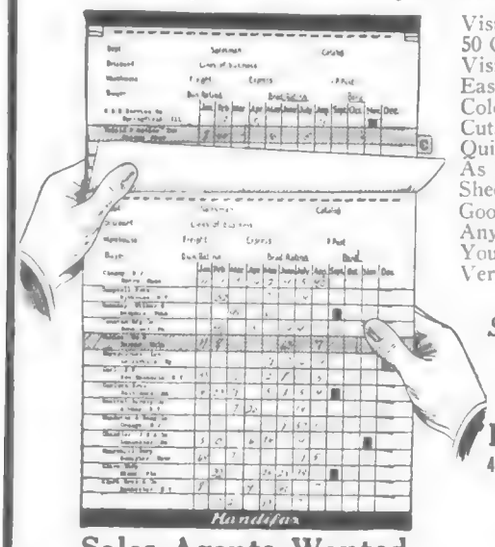

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Into the Fourth Dimension

(*Continued from page* 1042)

the Soul, though we have no name for it. I mean that something—the Divine-spark, if you wish, since only the Creator can supply it—which makes each individual different from every other.

"The qualities inherent to the individual—the qualities of its Divine-spark—mould and form the mentality. Characterize thus, what we call its sex. The one sex is a complement to the other. An attraction exists between them—a desire for proximity so that of their own inherent force they will draw together. And the one mentality derives force—a mental life-force—from the other. An exchange—for it yields its own necessary qualities in return. Thus we have the mating—the basis of the family. Without it no complete mental health is possible. There is no mentality capable of existing in health by itself."

"And a birth?" Will suggested.

"Communion of thought. The desire, the longing of two closely interwoven mentalities of complementary qualities. When they combine with an intensity of longing, the thought-matter they mutually create brings into existence another, smaller shape like themselves. It is very small—very tenuous—scarce to be seen save by those two who have produced it. It lies inert. Almost formless, though they sit beside it and strive with their loving thoughts of what it should be—strive to give it form. It may continue to lie inert; and at last in spite of their efforts, it may dissolve, dissipate—be gone, back into Nothingness from whence they drew it. The Divine-thought was not within it; it never was anything then save a human longing unblessed.

"Or again, the Divinity may be there. It lives. Grows ponderable. Moves of itself. Thinks of itself. Then it *is* something itself—something independent of all save its creator-divine . . . The little nourishment of its body is easily supplied; the mother-parent gives it lovingly the needed gentler nourishment of the mind; daily she adds to it the loving tendrils of her thought-matter so tenuous that to the sight it seems mere light.

"But if the spark is there, glowing brightly, the little Ego lives. Grows in size. Displays a growing mental capacity of its own. Its own mental qualities make themselves known, to identify it as a man-child, or a woman-child. And the Soul-Ego, developing, brings it to individuality. It is Itself;

(*Continued on page* 1046)

Articles In March "Radio News"

First Link of British Radio Beam System,
By A. Dinsdale

Construction and Theory of Wavetraps,
By James Wood, Jr.

What Is the Best Loud Speaker and Why?
By H. W. Secor

The Samson R.F.C. Receiver,
By Alfred J. Poté

The Ultra-5 Receiver,
By Theo. H. Nakken

The Phasatrol Balanced T.R.F. Receiver,
By J. F. Rider

A Description of the Loftin-White Constant-Coupling System,
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Into the Fourth Dimension

(*Continued from page* 1044)

unlike everyone else. The new Individual. . . . That, my friend Will, is a birth."

Will thought a moment. "There is a beauty to it—divinity clothes it, undoubtedly."

"Divinity clothes everything," Ahla put in.

Bee said, "I don't quite understand——" She gazed at Will, puzzled; and Will felt and understood her confusion. He said:

"Your explanation, Thone, seems to make Man differ from Woman only in qualities of the Soul and Mind. You do not speak of the body; yet to me, Ahla here appears of very different form from yourself."

Thone smiled. "You say, 'to me.' You have answered yourself, my friend. The physical aspect of everything is but the reflected image of it within our own mentality. The gentleness of Ahla—those qualities which make her what she is—are seen by you in the form of what you call a woman."

"But," protested Will, "does she not look the same to you?"

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"That I do not know," he returned earnestly. "Nor do you. We can only see, think, imagine for ourselves. Our conscious universe is our own; it exists of our own creation, and what it is of itself apart from us, I do not know."

"We have on Earth," Will said, "a school of philosophical thinking which believes that nothing exists apart from the mentality perceiving it. Believes that without a consciousness of existence, nothing can exist."

"That may be so," Thone replied gravely.

Bee was still puzzled. She said to Thone, "Ahla, to me, looks different from you. She looks, as Will says, like a girl. Won't you tell us how she looks to you?"

He thought a moment. "She looks—like Ahla," he said slowly. "I think we mould our images from the individual itself—not upon a generality of sex. She looks to me like Ahla, as I know her to be. Very gentle. Very dutiful. Very keen of reasoning. Very quick—" He smiled. "Yet not always so very logical. She looks like the Ahla of my creation—mine and that other mentality whom you would call her mother—" His voice turned solemn, with a singular hush to it. "Her mother—who has long since gone into that realm of mystery—behind the veil we must not penetrate."

At other times they talked of practical subjects. Brutar's coming invasion of Earth; my own fate, since I still was missing, unheard from. And they talked of what could

(*Continued on page* 1048)

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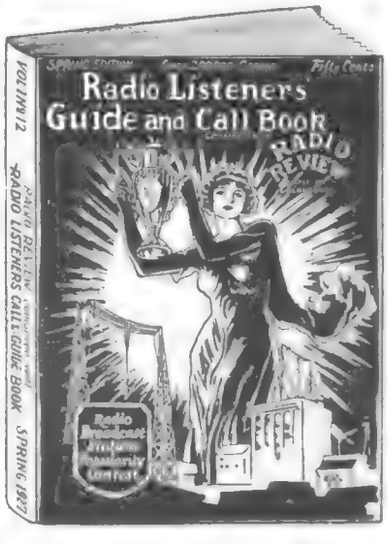

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Into the Fourth Dimension

(*Continued from page* 1046)

be done to overcome Brutar and his horde of followers.

Thone, it seemed to Will, had accomplished very little. He had learned of Brutar's purpose; and of the establishment of his realm. Thone had sent—by the aid of the Iolos plant—an adventurer into the Borderland who had seen Brutar and some of his cohorts experimenting with the Earth-state. Then Ahla had gone into the Borderland; had met Will; had arranged to bring him, Bee and myself back to see her parent.

Little of accomplishment! A public meeting of protest, which we had attended; and which Brutar invaded. But now Thone was organizing his Thinkers—his army, as it might have been called on Earth. Their purpose was to seek out Brutar's realm by concerted effort of thought; to find it while Brutar's preparations were still incomplete; and to destroy it.

The very conception of warfare of this kind was difficult for Will to encompass. There were no weapons—nothing of the sort we on Earth would call weapons. Will showed Thone his broad belt, and the contents of its pouches. He drew out a revolver and a knife. Thone inspected them curiously—shadowy, glowing objects which almost floated when tossed into the air, so imponderable were they.

Will explained their Earthly uses. He said, a trifle shamefacedly, "I brought them—but

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I felt they would be of no advantage here."

He pulled the trigger of the revolver. If it discharged, there was no result which his Ego-senses could perceive. Thone said, handing him the knife, "Strike me with it."

The action was instinctively revolting; yet Will drove the knife-blade into the semblance of Thone's arm. Thone said, "It seems to hurt."

To Will the knife might have been a feather he was thrusting against a pillow. He withdrew the blade; fancied he saw in Thone's arm an open gash. But if he did, the gash closed at once. The outlines of the arm were quivering, unreal, under Will's earnest gaze. And he knew that if he persisted in regarding it, the arm would turn formless to his sight.

He exclaimed, "Useless! Of course." And tossed the knife away. But Thone recovered it. "In the Borderland it would be more effective, Will. Keep it."

Thone explained how his army of Thinkers might destroy Brutar's encampment. The thought-matter, created, was held in substance only by continued mental effort. And this, withdrawn, at once the disintegrating forces of Nature would dissolve it into nothingness.

"So it is," Thone said, "when an Ego dies. The persistent, subconscious effort of mind during life is all that holds the shell of body in existence. Withdraw that—and you have dissolution."

"And with inorganic matter—" Will began.

"With this globe, for instance," said Thone. "With everything we have created, a worker-mentality must guard it. Replenish it."

To Will that seemed not very strange. "On Earth," he said, "we must repair. Nature slowly but steadily tears down that which we have built."

(*Continued on page* 1053)

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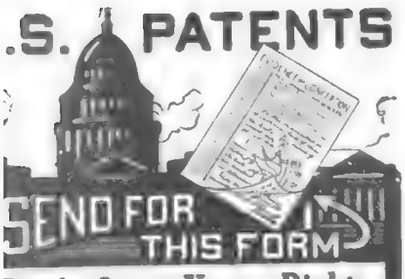

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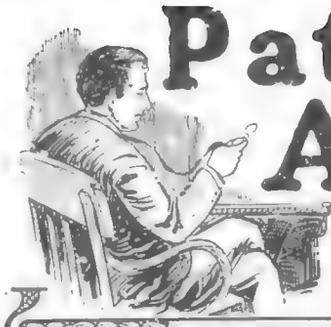

Edited By
Joseph H. Kraus

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AIR OPERATED AUTO

(1001) Q. 1. Warren Morton, Lebanon, Ore., submits specifications of an automobile which is to transform current supplied by storage batteries into power (operating an electric motor) and said power is employed for pumping air to a tank and the air in turn is used to operate an air engine which is connected to the wheels of the automobile.

A. 1. While we admit that the cost of keeping the battery charged, and oiling of the engine as well as replacement of the wearing parts would be the only expense in your air compression engine, we also would advise that the transmission is very inefficient, with the result that instead of obtaining all of the power from your battery and using this directly to drive the wheels of the automobile, you are first converting this into air pressure, then storing it into a tank, then using the air pressure to operate a motor and the wheels. Each one of these changes in transmission represents a loss, with the result that at the end of the entire system, the efficiency will be less than 50% of the energy secured from the storage battery. It is far better to couple electric motors directly to the wheels of the automobile than to resort to the various changes outlined in your description.

Insofar as charging up the storage battery from the generators on the car is concerned, we would advise that you cannot accomplish this because there are losses again incurred in running your generator and these losses cannot in any way compensate for the energy necessary to drive the mechanism. We do not suggest that you apply for a patent on the idea, it being absolutely impractical.

SAUSAGE SKIN SUBSTITUTE

(1002) Gustave Freund, Chicago, Ill., asks us what we think of an idea for an artificial sausage skin.

A. It is quite possible that your method of making artificial sausage casing would find a market and that it is probably patentable, but we do not see any reason for such a development.

At the present time one well-known brand of ham is not put in a natural casing, but is put in a cloth bag, and there are various other brands of sausages and bolognas which are wrapped in artificial coverings, as for example the popular cellulose covering for frankfurters.

If your particular casing is very resilient and possesses toughness, and yet at the same time may be easily removed from the sausage meat or be edible and if it is impervious to water and is airtight, and yet is as cheap or cheaper than regulation types of sausage casings, we believe that your invention might find a market.

We are inclined to urge extreme caution and much experimentation in patenting an idea of this nature.

"FOUNTAIN" SOLDERING IRON

(1003) Mr. L. A. Prashak, Portsmouth, N. H., asks our opinion of a soldring iron with a reservoir for the solder. An adjustable feed is provided.

A. We have carefully looked over your improvement on an electric soldering iron, and would advise that the idea seems sound, and we do not see why you could not make quite a salable article of this device, particularly if it were experimentally proven and then manufactured at a reasonable cost price.

It is obvious that the average radio experimenter would not care to pay a very large price for a soldering iron, when the only advantage he gains is the fact that he always has solder available for instant use, and it is questionable whether this solder, being constantly heated, would not tend to crystallize more quickly than the small amount which is usually needed to make a joint. Of course, we do not mean to imply that your iron should be limited to radio purposes only, but it has been found by manufacturers in the past that an electric soldering iron which would be suitable for the average radio experimenter does have a much greater sale than the more expensive irons of rather limited use.

We would certainly suggest that you get figures on the manufacturing cost.

We do not see the advantages of the sealing screw in your illustration, inasmuch as it must constantly be removed for supplying the extra quantity of solder necessary to keep the chamber quite full. This solder may melt in the vicinity of the screw and permanently solder it in place, making it necessary to heat the iron before the screw can be removed. It further produces a partial vacuum in the iron when in use and makes it necessary to handle a hot article whenever it is desired to replenish the supply of solder.

POLARIZED LIGHTS

(1004) Harry P. May, Los Angeles, Calif., submits a sketch for a system of headlights and windshield on cars which cause (by their interaction) a polarizing effect. This makes it impossible to see the glare of headlights of another car. He requests our advice.

A. Referring to your communication concerning patent advice on automobile headlights and windshields, we would advise that although the idea seems perfectly logical it is entirely too expensive to be worthy of further consideration. Your thin glass plates, serving as the lens of your headlight, are inclined at an angle, which makes the lens subject to breakage, not only from objects dropping down upon it, but also objects flying up from the road and striking the lens.

Incidentally, the angle of the headlight and the angle of the windshield must be set, and it would be necessary to regulate the angle by law. It is obvious that an ordinance must be passed necessitating the use of this type of a headlight and in view of the fact that, if patented, the idea could be developed by only one organization, and in this manner it would prevent competition, we doubt that you could ever persuade the legislatures of the various states to accede to your demands.

Your particular device also necessitates that the windshield be inclined at a certain definite angle, and that the windshield be constructed in the same manner as the headlights, namely of multiple sheets of glass. Here again we entail an expense, and insist that manufacturers build cars to accommodate a windshield inclined at a predetermined angle. Again competition would be prevented and a legal requirement would have to be made for the particular type and construction of a car, which we doubt if you can possibly foster.

We certainly do not advise that you apply for a patent on this suggestion.

(*Continued on page* 1052)

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STORM PROOF UMBRELLA

(1005) Walter Farbanish, Old Forge, Pa., asks our opinion of an umbrella which is provided with a system for permitting passage of air from the hollow side of the umbrella.

A. We believe that the stormproof umbrella which you have designed, even though basic in construction, would not be practical, and we would suggest that you build up one or two working models and try them out in a strong wind or rainstorm.

We do not believe that the openings at the top of your umbrella are sufficiently large to permit of a free passage of air, and so prevent the umbrella from turning inside out. Many umbrellas on exhibition in front of stores do have big holes cut in the cloth, and even these turn inside out in violent storms. At the same time you must remember that these umbrellas are free to swing around on a suspending pivot, so that the wind at all times is acting directly upon the top of the umbrella, rather than blowing into it from its under surface.

We do not advocate proceeding with a patent on the suggestion unless you are thoroughly assured that the device is practical.

PHONE COIN BOX

(1006) Leon A. Martin, Detroit, Mich., requests our opinion of a simple, cheap box to be attached to private telephones which is to serve as a gentle reminder that a fee of five cents is to be collected for any calls made by others than the subscriber.

A. The attachment of a small box to the telephone serving for the collection of the moneys for the telephone calls would not cause people using the phone to drop the money in this box. If the individual willingly forgets or even unconsciously forgets to pay the five-cent fee, this very gentle reminder would not cause him to do so.

The telephone companies object to the attachment of any devices or other articles to the telephone which are not parts of their equipment. Consequently such a box would be removed by every telephone company employee who inspects the telephone.

Should the box contain a few cents in change, it becomes a simple matter for a thief to remove the box from the telephone, by either breaking it off or unscrewing it or to tip the telephone upside-down and cause the money to fall out of the box or to open the hinged top or back.

We do not advocate securing a patent for this system as it is no better than a small box attached to the table top for the collection of the phone call fees and in our opinion it does not constitute a claim for a broad patent. The idea itself, as we have pointed out, is far from practical.

CONTRACT BEFORE EXAMINATION

(1007) Miss Mary Purdue, New York City, asks us where she could sell a nameless article. She claims a universal demand could be developed.

A. It is very difficult to tell you where to dispose of a device, the nature of which you do not give, but merely state that you believe a universal demand could be made for the system. We do not believe that any organization in the country will undertake to purchase your invention under the terms outlined in your communication, namely that you will not disclose your invention to anyone before you shall have assurance that you will be properly protected with regard to royalty. Anyone purchasing an invention of that nature could be likened to the individual paying for a cat in the bag. It is evident that any manufacturer desiring your invention would have to know what it is about, whether it will fit in with his line of business, whether there is enough demand for the system and whether he is in a position to force its sale. You might have an electrical washing machine and approach a manufacturer of stamped household articles.

We regret that we do not know where you could place your device on the market and would suggest that you look through a register of manufacturers most likely able to sell the article which you have designed.

NON-SINKABLE LIFE BOAT

(1008) Charles Morris, Maspeth, L. I., asks our opinion of a submarine-like non-sinkable life boat provided with a life saving basket for the purpose of catching anyone leaping from a ship. He wants our opinion of the system.

A. Undoubtedly you would be able to obtain a patent upon your proposed type of life saving boat, but we are very much of the opinion that you would encounter very great and serious difficulty in attempting to commercialize it successfully. To do this would probably require the investment of a large amount of capital in order to build working models and in order to promote the entire business.

We have had several very complicated non-sinkable life boats submitted to this department in the past and it seems that the opinion of shipbuilding companies in general is that such life boats are not feasible in actual practice.

Your device is more complicated than many and less practical than most of them.

We would, therefore, advise that even though you might be able to obtain this patent as mentioned above, you do not proceed further with it due to the many difficulties that you would encounter. These difficulties have been proven by the past experience of other inventors working along similar lines.

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Into the Fourth Dimension

(*Continued from page* 1048)

"Of course," Thone responded. "We will destroy Brutar's encampment, himself and all his followers. Rather should I say, we will force them to stop replenishing—and Nature will destroy."

Then Will said, "Let me ask this: I understand that if you, with your weaving of the net of thoughts, are quicker, more powerful than I, you will beat down my resistance. Entrap me; force my body to follow you."

"Or to depart from me," Thone added. "I could force you back—as far from me as I could spin the net."

"I was thinking—suppose we must fight them in the Borderland—"

"A combat at once physical and mental," Thone retorted. He smiled. "You think we are ill-prepared, Will? That is not so. My men of Science have studied this condition—experimented with it very fully. The Borderland—the transition into your Earth-state—all such things are new to us. But we are coming to understand them. And I think that Brutar's people know little of their subject . . ."

He paused in contemplation; then went on slowly. "We are not sure how permanent may be the transition by the lolos-blood into the state of your Earth-matter. Brutar may be mistaken in that—"

He paused again. His smile had a gleam of irony; and there came into his voice an ironic note. "I am not sure but that from the Borderland, our opposing thoughts might not reach your Earth-state. They might, perhaps, do strange things to those of Brutar's people who have reached there—who have taken with them what they may think are effective weapons."

That Thone had learned, or divined much of Brutar's purpose, and that he was prepared to combat it, was evident. But at the moment he chose to speak no further. He added abruptly, "My Thinkers are organized. Very soon they will be ready. The mind, my friend Will, grows strong only with use. Every moment that they can, they are developing the strength of battle . . . Come here and see."

They passed upward upon the side of the globe; and at once its opaque wall began to glow; become translucent; transparent, until through it Will saw the city. An open space, from this angle seemingly tilted on end, was nearby. Within it a horde of shapes were squatting. Figures which after a moment of inspection seemed men—gaunt of body, but with craniums distended. A horde—a myriad; Will could not have guessed at their number. Squatting in a giant spiral curving inward to its center point. From the heads of them all light was streaming. It spun in a band close over them; whirled, flashed with iridescent color. A spiral band of light, concentrating at the center point into a beam that shot away and was lost in the darkness.

The globe wall became again opaque; the scene vanished. Thone said softly, "There is much power for combat in mentalities like those. And very soon I will put them to searching for Brutar's realm—"

A cry from Ahla interrupted him. The girl had been seated as though in meditation; but now she flung herself erect.

"I can find this encampment of Brutar—I can lead you to it now!"

Thone stared.

"Are you getting thoughts from it?" Will demanded eagerly. And Bee gave a glad exclamation. She asked, "Is Rob there? Is he safe, Ahla? Can you take us to him?"

"I do not know if he is there, or safe. Oh, I cannot tell you those things! I only know I can take you to Brutar's realm!"

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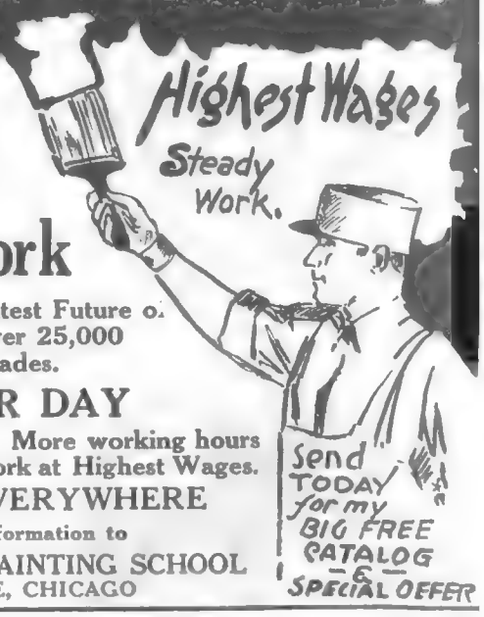

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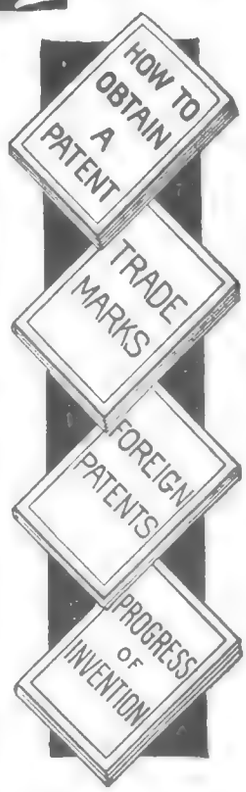

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"You feel no thoughts from there?" said Thone.

"No."

Thone was standing with the others. No delay now. He was ready. He said to Will, "It is the nameless power. Those only whom you call women have it."

"Intuition," Will supplied.

"We say, the nameless . . . You may try, Ahla. And if once you take me there—" A restrained, grave triumph was upon him.

"Once I will have been there, with perfect sureness I can lead our Thinkers to the attack."

Again in the void . . . The power of woman's mentality—the nameless power; illogical, against all reason, all science; not to be explained. . . . But it was leading them . . . A rush through the darkness of vague, unreasoning woman's thought; a distance, a time felt, but unmeasurable; a direction not to be fathomed . . . And then, ahead of them as in a clinging group they followed Ahla, the glow of a poised realm became visible. They neared it; hovered in the void regarding it. And knew and saw that it was Brutar's realm—that great, tenuous globe hanging there like a gigantic bubble. They could see within it; see details as though by some magnification the details were close at hand.

The encampment was deserted! Abandoned! The lolos field was uprooted; its plants gone. The globes, the workshops, the streets, fields—all were deserted. And more than that, with the removal of all conscious, constructive, replenishing mentality, disintegration already was taking place. A leprous realm. Holes of Nothingness were visibly eating their way into everything. Rotting walls . . . rotting habitations . . .

Under the gaze of the watchers the whole realm was melting. Dissolving into slow-flowing viscosity; cesspools of putridity, rising into mists, vapors—a puff of Nothingness . . .

The realm was vanished. The void was black, empty and silent. The little group of apprehensive watchers turned away.

Brutar—presumably taking me with him—had already started his invasion of Earth!

(END OF PART 7—*To Be Continued*)

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When SCIENCE AND INVENTION Magazine was still in its infancy, the editors denied the possibility of constructing a perpetual motion machine using those forces of nature as we now know them.

Since that time the editors have received thousands of different designs for perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

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Our Spiritualistic Investigations

By DUNNINGER

(*Continued from page* 1006)

or there, which consisted only of conversation complimentary to the extraordinary power of our spirit worker. Finding, as I did, a rather refined-looking gathering of the waiters, and a large number of intelligent looking subjects, I gathered that the medium must be of unusually good deceptive ability. As I walked into her chamber of manifestations, I was impressed by the brilliant illumination of the room. Lamps galore, with bulbs of the brightest kinds, had quite a dazzling effect upon the eyes. It seemed that this unusual feature was of some strange significance. The real reason thereof did not present itself, however, for the moment. A stern, short, sickly looking figure was Madame Lowe. Without a smile, and apparently uninterested in her subject, she asked me to be seated alongside a small table, which stood directly in the center of the room. She, seated at the opposite side, directly facing me, was dressed entirely in black, the monotony thereof relieved only by an odd oriental pin, worn directly in the center of her bosom. She stared into my eyes, and started to question me. A sort of third degree followed. Her questions were direct, and she seemed merely anxious to satisfy herself as to whether or not, I was actually anxious to speak to some one in the spirit world, or merely an inquisitive visitor, desirous of experimenting with her ability. Her form of questioning seemed to assume almost an indignant manner. I informed the lady, in a manner as simple as possible, that I was a disbeliever in any psychical manifestation, and was anxious to be shown. Contrary to my expectations, she was not upset by my frankness, and merely requested her fee, before beginning her so-called performance. Why so many mediums have adopted the money-first plan, is still an unsolved mystery. The two dollars I promptly produced, and placed in her slender, bony fingers, which were extended to receive the money. She placed these bills in a large cash box, which stood in one corner on the table. As she did this, I caught a glimpse of a stack of green-backs, which would have been creditable to a small town banker's cashier window collection, on a busy mid-week closing sale. The studious looking gentleman had by this time re-entered the room, and placed a large slate directly in front of me, together with two or three pieces of chalk, which had been sharpened to fine points. Without much hesitance, Madame Lowe asked me to write the questions I was interested in, upon one of these slates, and sign the name of the person to whom the message was directed. I proceeded to do this, and wrote . . . "is Adeline happy . . . shall we meet again . . . what became of your will? . . . we cannot find it." As I wrote upon the slate, I watched the me-

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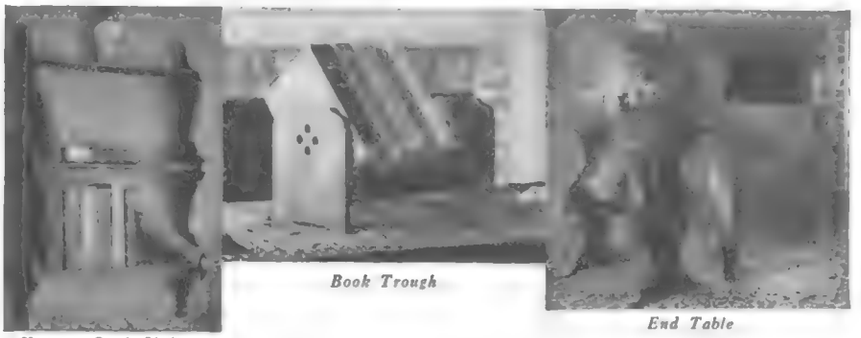

Hanging Book Shelves *Book Trough* *End Table*

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dium carefully, and was impressed by her indifference. Never for a moment did she glance in my direction. Her bearded assistant had left the room before I began to write, so I was quite sure that I alone was the only one familiar with the questions upon the slate.

All of this precaution, however, was useless. As I had completed the writing, the medium asked for the slate, and read out aloud what had been written upon it. This was entirely contrary to my expectations. I now sat back silently, and awaited developments. The medium asked me to concentrate upon these departed spirits. A moment or two elapsed, when the door opened, and the elderly gentleman again entered, with two or three additional slates, which he handed to Madame Lowe. The medium removed the uppermost slate off the stack, and proceeded to wash the surface thereof. First the one side, and then the other, was apparently cleaned with a moist sponge. She handed me the slate and asked me to assure myself that there was no record upon either side, and I was then instructed to place the slate flat upon the table top before me. Additional advice consisted of asking me to place my outstretched palms on top of the slate, and strengthen my concentration. Several moments more elapsed. I was asked to remove the slate from its present position, and look at the under surface. This I did, and found this message, quite legibly written, apparently with slate pencil, the script entirely covering the surface of the slate: "Dearest one. . . . I am extremely happy. . . . My spirit is at rest. . . . It longs but for you. . . . I am otherwise contented, and am looking forth to meeting you some day in this beautiful world. . . . Look again. . . . I am sure you will find the will. Adeline."

With the usual flow of conversation, such as is customarily offered as an exit speech, and with a look of conquering satisfaction upon the face of the medium, I was ushered out into the ante-room, and from there escorted to the outer door by the elderly gentleman. I was asked if I cared to make a future appointment with Madame Lowe, as unusual messages from the spirit world could be obtained from time to time, through the agency of her mediumship. No appointment was made, however, it is needless to state. The *modus operandi* resorted to was as follows:

The statement written upon the slate was secretly conveyed to the studious looking gentleman, who awaited the information in another room. A dictaphone was concealed in the séance room. As the medium read my writing out aloud, the gentleman at the receiving end of the apparatus prepared an answer to my question, upon the slate which he afterward brought to the medium. The well written and carefully worded apparent spirit message, he lightly scratched upon the slate, with a pencil, made of glass. The prepared side of the slate was carried downward, so as not to be visible, when the stack of slates was handed to the medium. The moistened sponge was passed over the writing, and made it temporarily quite invisible. It was, therefore, safe to hand me the slate for rapid inspection. The wet surface disguised the presence of the writing entirely. As the slate rested on the table and during the few moments the medium employed by conversation, the slate had ample time to dry, which brought the message quite legibly to the surface. The small cost of the slates, especially when purchased in wholesale quantity, compared to the fee charged for a sitting, naturally netted quite a profitable income on each and every one of these demonstrations.

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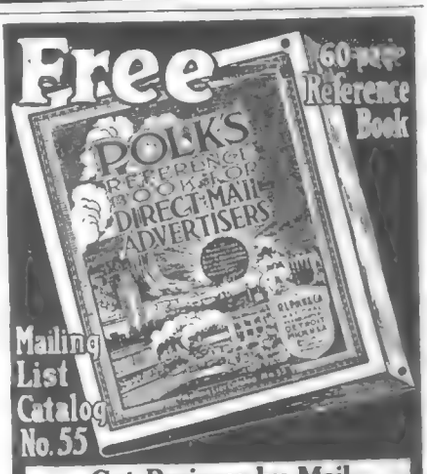

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Solving Metropolitan Traffic Congestion

BY HUGO GERNSBACK
Member American Physical Society
(*Continued from page* 1003)

mobile traffic congestion, by a rather simple and somewhat unique system.

It has already been proposed to run an elevated automobile speedway in a sort of belt line paralleling the Hudson River down to the Battery and thence up on the East Side. This speedway would be used only for express purposes, and, inasmuch as there woud not be any cross traffic, high speeds anywhere from 35 miles per hour upwards could be maintained, and thus move the vehicles rapidly. This, of course, will help the congestion a great deal and will take a great many automobiles off the street.

At the present time, New York has, in the district below 53rd Street, four elevated railways, namely the 9th, 6th, 3rd and 2nd Avenue lines. The 6th Avenue elevated merges with the 9th Avenue line at 53rd Street and 9th Avenue. From that point on, we have only the 9th, 3rd and 2nd Avenue lines.

These lines threaten to become obsolete, for the main reason that they no longer seem to pay. Some of the lines have been in bankruptcy for some time, and it has been frequently proposed to tear down the structures entirely, for the reason that they are unsightly. This is, of course, admitted, and the scheme that I propose herein will not improve their appearance, but I believe that the growth of the city and the business of this city warrants drastic means in order to clear the traffic and keep the business of the city moving. I know that the scheme that I propose will not meet with favor from the property holders adjoining the elevated lines, but whether they like it or not, sooner or later a system such as I shall propose, must come into use, otherwise the property holders themselves may not derive any benefit from the very property in question.

In short, my plan is to place a roadway on top of the existing elevated structures, with approaches only at infrequent intervals. This elevated roadway would accommodate four automobiles abreast and would not interfere with the elevated railroads running underneath the automobile speedway. In my system there would not be any crossway traffic either, as no automobile would have occasion to make a left-hand turn. As the approaches are infrequent, being only, for instance, at Battery Park, 14th Street, somewhere in the 40's, 66th Street, and 125th Street, quick motion would be gained. The ramps would be constructed in such a way that they would be the width of only one single car, the ramps taking about two blocks to make the climb from underneath the elevated structure up to the speedway. These ramps would be placed only at such parts of the city where they would not go directly over a sidewalk, and would not take up any space of the street. The ramps would go down on an incline and not end at the side of the elevated railroad, but, rather, curve underneath the elevated railroad, where the start would be made.

The roadbed itself would, of course, be of steel, with a thin layer of asphalt or the like, and the weight, therefore, would not be prohibitive. By this system it is calculated that at least 50 per cent of the present automobiles could be removed bodily from the streets, and thus give much needed room. The elevated automobile speedway could, of course, be used not only for passenger cars, but for truck traffic as well, should this be desired in order to keep traffic moving.

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I also propose that somewhere along the 40's a crosstown connection could be made, which would connect all of the elevated speedways together, in order that vehicles coming from the east could travel to the west, and those from the west to the east. So as not to take away the light in any now-existing street, I propose to run this crosstown connection bodily over houses in the middle of a block, wherever the conditions are such that the roadway would not have to be elevated to too great a height in order to make this possible. In the midtown sections, where there are no extremely high buildings, such a crosstown connection could be readily effected. Another such crosstown connection could be effected either above or below 125th Street, preferably somewhere near 126th Street, where there are no very high buildings.

A scheme of this kind is, of course, an expensive one. It will cost many millions of dollars to see it through, but there is a simple way to raise the money, on the following plan:

At the present time some of the railway companies are in not too healthy a financial condition. It is proposed to issue tickets, which can be bought anywhere in the City at the rate of 25 cents per ticket for the use of the roadway. No automobile could go on the elevated roadway unless the driver paid such a sum, or a sum to be decided upon. The enormous amount of traffic that would immediately revert to the new speedways would make the venture a highly profitable one for the elevated railroad companies, and would satisfy the present stock- and bond-holders, because the earnings, no doubt, would run very high in a short time.

There are no technical difficulties in a plan of this kind. It is more in the nature of a financial problem (to raise the money in order to build the structure and give the city relief). On the whole, it is a business proposition and will be worth untold millions in benefits to the city at large.

Corrosion-Proof Aluminum at Last

By DR. ALFRED GRADENWITZ

(*Continued from page 996*)

against the action of atmospheric agents and sea water. Coated aluminum sheets have been found to be an excellent substitute for tinplate in connection with roofings.

The electrical industry should likewise be benefitted by the new process, for coated aluminum is in many cases an excellent substitute for the much more expensive copper, and in connection with the construction of scientific instruments and apparatus, it will largely be used in the place of brass or copper. Chandeliers and other lamps made of aluminum with a coating of copper or some other heavy metal are particularly attractive; when made of silver or gold-coated aluminum, they look to all intents and purposes like solid silver or gold articles.

Other products which have already been made to advantage of "Sprencorized" aluminum (as the process is commercially termed) comprise table requisites, kitchen utensils, soldiers' flasks, hair-driers, bathroom outfits, wall pegs, door handles and fittings, radiators, etc.

According to a series of stringent tests carried out at the *Chemische-Technische Reichsanstalt*, the German counterpart of the chemical section of the Bureau of Standards, the resistance of these coatings to atmospheric agents and salt water is most satisfactory and their adhesive strength remarkable. Various aluminum ware manufacturers are being licensed by the company controlling this invention.

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Home Mechanics
WILLIAM M. BUTTERFIELD

(*Continued from page* 1016)

and screws fitted at this time also.

F.—The trough consists of two ⅝ inch boards 34 inches long and 4 inches wide. One board is rabbeted to form a ⅝ inch lip to cover the lower edge of the other board. The two sit together at right angles so as to form a trough (as shown). The ends of the trough thus formed are secured in V-shaped grooves cut in the end pieces G. A bolt 1. holds the ends in the grooves. The grooves should fit the ends of the trough tightly so that the joints can eventually be glued, and thus further secured. (See H.)

G.—End-boards or under-braces are made of ⅞ inch lumber and are 5½ inches wide, with ½ inch tenons at each side or 4½ inches between tenons, and 6 inches long. They are shaped as shown at G. A V-shaped groove and hole for rod I is cut and bored as before described. The center of the hole is 2½ inches from the bottom end, and the lower angle of the grooves 2⅜ inches above the bottom end. The rod thus sits into the angle of the trough ⅛ inch—a groove being cut at this angle for the purpose. Fig. H shows the trough, rod and end-board.

I.—In order to secure the trough ends in the end-boards, and to give strength to the table, a ¼ inch iron rod with a head, two washers, and a nut is used. The rod is 34⅛ inches long under the head. It extends through each end-board, with a washer under the head and a washer under the nut, and is bolted tight and firm. In order to hide the rod head and nut two buttons are turned and countersunk for the washers, then cut out to closely fit the head and nut. One is finally glued over the head and one over the nut to the outer sides of the end-boards, as illustrated at I and H. These buttons will prevent the nut or rod turning and thus becoming loose.

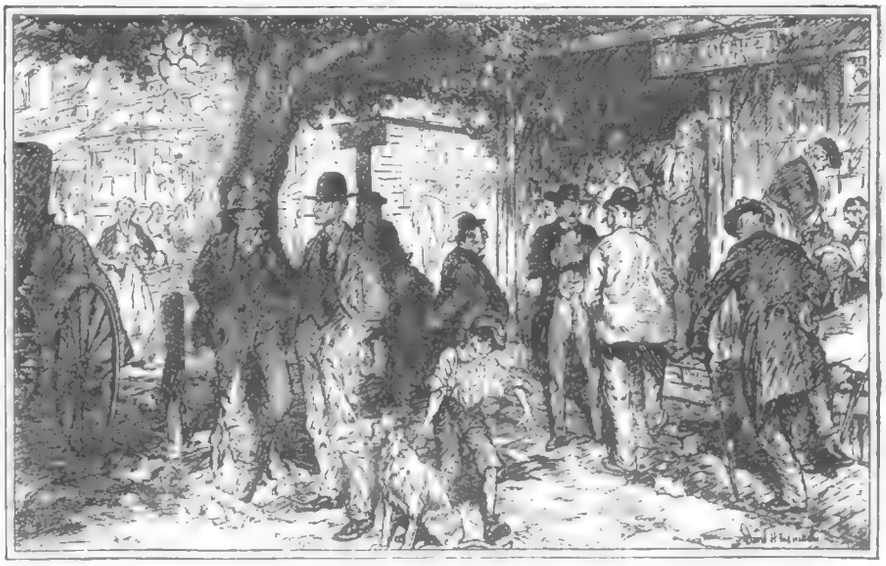
The table will properly stand a high finish. In order to obtain this it will be necessary to remove all scratches, dents or checks before staining the wood. An oil stain is best for staining any of the woods mentioned. When this is dry another careful smoothing down must be given to the table. Any filling that is required at any of the joints can now be done, using the stain to tint the filling material. The first coat of varnish is then put on, allowed to dry, and rubbed and smoothed down as directed by the makers of the varnish used. A second, and occasionally a third, coat is used, with the usual smoothing processes recommended between coats. It is rather a painstaking process to obtain a highly finished piece of furniture, yet the finish obtained is very gratifying and lasting.

The woods most often used are walnut and mahogany, although occasionally a maple or oak table is seen. The prices range from $9 to $30, the cheaper tables usually being in imitation mahogany and having an inferior finish. The materials and mill work should not exceed $5.50 for any wood named.

TOOL LIST

The tools required for building the Book Trough End Table will vary with each mechanic perhaps, but he will find handy a good crosscut saw, small smoothing plane, compass or keyhole saw, large hand drill or brace and set of bits, several sizes of wood chisels, rabbiting plane, and sandpaper both fine and coarse.

Send us your ideas as to articles you would like to see described in this Department.



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Readers Forum

(*Continued from page* 1029)

2. THICKNESS, is the direction at right angles to the length, which extends the smallest distance.

3. BREADTH, is the direction at right angles to both the length, and thickness.

4. LOCATION, is the position of an object, relative to the other objects in its effective sphere. It is determined by the distances separating this object from the other objects relative to it. It is apparent from this, that location is not fixed; location is comparative; an object can change its location without having entered a state of motion (since motion, as well as location, is comparative, motion is naturally entailed in a change of location, but what I mean is that an object can change its location, without any energy having been used by it in the process), because any change in the position of the objects relative to the object under consideration, would naturally change the distances, from these objects, of the object under consideration, and its location accordingly.

TIME, that is time as it effects any particular object, is wholly a state of mind, without which there would be chaos; it is that something which separates events and objects from each other, and makes existence possible. The time of any particular object, or event, is the particular point which this object, or event occupies, on the flow of this quality, known as—TIME.

SCOTT GRAHAM WILLIAMSON,
San Francisco, Calif.

(This is an interesting thought, and is worthy of publication on the Readers Forum page. It will undoubtedly stimulate thought and anything which stimulates the brain cells is worthy of publication. While we have no direct comments to make on the subject of location as a dimension, we certainly believe that the theory is infinite in its ramifications. What would be the location of an electron? What is the location of the planets in comparison with this earth, assuming the possibility, as at least plausible, of light rays being bent? What is this location with reference to the other stars in the heavens and what is the location of those stars with reference to other stars outside of the range of our telescope? If this entire conglomeration of stars forms a part of one great system, then what is the location of the system with reference to other systems outside of the sphere in which we live and which we can only conjecture. Think it over.—EDITOR)

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Motor Hints

BY GEORGE A. LUERS

(*Continued from page* 1020)

REPAIRS TO A THREAD IN THE BASE OF THE ENGINE OF CAR

Many car owners, after changing the engine oil, have difficulty in replacing the plug in the base of the engine without crossing the thread. It is awkward to work under the car and before the damage can be detected, it is likely that the plug has been forced all the way in.

The dripping of oil at this location cannot be tolerated, for which reason an immediate repair is required.

To make the repair, without resort to machine shop equipment of special size of drill and tap and without making the drain plug a special size, the work proceeds as shown in the sketch on page 1020.

This consists in securing from the service station, two drain hole plugs.

One of these plugs is filed carefully, relieving the first two threads and forming flutes in the sides, corresponding to a tap with flutes.

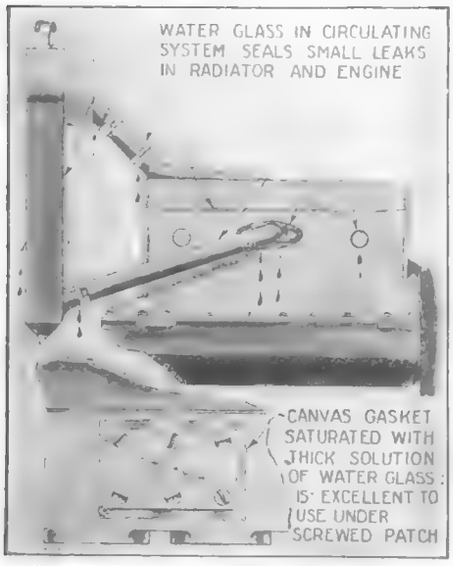
The improvised thread tap, is then case hardened by use of cyanide or bone dust, to carbonize, and quenching.

This plug tap is carefully entered in the broken thread and turned in as far as possible, or until the head shoulders against the crankcase.

The other plug is then used for the regular use as an oil retainer, but the old plug must not be entered in the hole again.

WATER GLASS IN RADIATOR LEAKS AND BROKEN ENGINE REPAIRS

The persistent drip from a small radiator leak or through a defect in the engine block is annoying and a source for constant attention to maintain the radiator filled. With the thermo syphon system, it is essential that the radiator be filled above the top hose level because the circulation will cease when the


WATER GLASS IN CIRCULATING SYSTEM SEALS SMALL LEAKS IN RADIATOR AND ENGINE
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One of the best means for sealing leaks in radiator and the water cooling system of automobile engines, is by the use of water glass or sodium silicate. Four to six ounces of the water glass dissolved in the radiator water is sufficient.

level is below this point and overheating will occur in less than a mile of driving.

Flaxseed meal, cornmeal, bran, mustard, oatmeal or the whites of eggs are used in many instances to stop these small leaks. Any of these can be placed in a hot radiator, except the whites of eggs, which must be dissolved in cold water.

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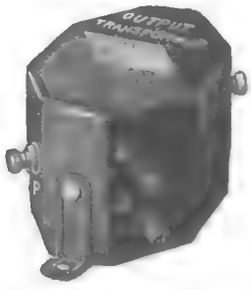

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in the radiator, sand holes in the castings, small cracks in the engine head or leakage around the disc-shaped core hole covers in the side of the engine block is with water glass or silicate of sodium, which is the trade name.

From four to six ounces of this can be dissolved in the radiator water and it circulates through the system, seeping out at all openings.

At the places or points of seepage, it will harden on contact with air and forms a most effective seal.

Where a small break in a casting is repaired with a patch, a canvas gasket under the patch, coated with a thick solution of water glass, will form a most effective seal against leakage at this point.

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OVERHEAD VALVES GROUND WITH TOOL FOR ATTACHING TO STEM

Some owners boast of the long periods they drive their cars without valve grinding or adjustment. The need of grinding them periodically is shown by the fact that neglected valves are cut and pitted on the valve face and cylinder seat, making it necessary to remove much metal with valve seating tools.

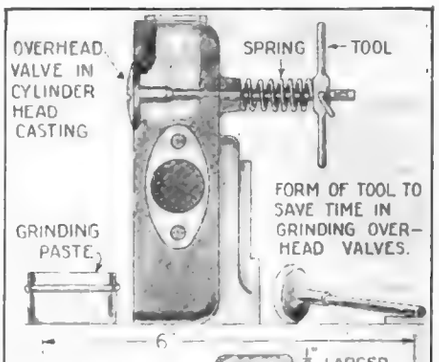
The overhead valve is one of the troublesome types to grind and is the one type most likely to be neglected for reason of the trouble.

A fast, serviceable and satisfactory means of grinding the overhead valves, of a removable cylinder head especially, is through use of a simple tool shown in the attached sketch.

This tool is made similar to a tap wrench and instead of attaching to the head of the valve, it is attached to the stem. A small spring is used under the tool and against the face of the casting to bring the valve firmly against the seat.

The tool is partly rotated to give the usual oscillating movement for grinding in the seat. Replenishment of the grinding compound between the valve and seat is accomplished by compressing the spring and the position of the valve is also changed by pushing down against the spring.

This tool will save time and effort in grinding valves on any cylinder head of the type on which it can be used.



The illustration above shows a simple tool which can be attached to the stem of overhead valves for the purpose of grinding the valve and seat.

Wood Whittling

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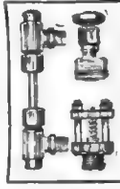

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The Big Book Review Section in This Issue

WATCH FOR IT EVERY MONTH

REVIEWS OF LEADING BOOKS

Why a Cat Always Lands On Its Feet

(*Continued from page* 995)

swing further than the long one does. We say the moment of inertia of the long pendulum is greater than that of the small one, and now we will apply the moment of inertia to the cat. When the cat falls, it can make its hips and rear of the body pivot, as referred to the chest and front of the body, around an axis represented by its vertebral column. By the reaction the hind legs and hips turn in one direction, while the thorax turns through the same angle in the opposite direction.

The secret of the cat's action is that it modifies the moment of inertia of the parts of its body which do turn, so that one turns a little further than the other and in the proper direction. When the cat is in the air it can extend or draw back its paws. It can make the rear part of its body represent a short pendulum by drawing in the hind feet, so as to reduce the moment of inertia of that part of the body. By the reverse action, it can increase it. In this way it can make the moment of inertia of the rear of the body less than that of the front by the action of the paws. And now, as we have seen in the case of the two pendulums, the arc described by the rear of the body will be of greater angular magnitude than the arc described in the opposite direction by the front of the body and the thorax. As a result, the rear of the body gains in the angle of rotation in the opposite direction to the motion of the front of the body. Now, drawing in the legs which it had extended, and extending those which it had drawn in, it will make a gain once more in the same direction and so on.

First: The hind legs are kept extended, the front legs are drawn closely to the body, the thorax turns, we will say clockwise; the rear part of the body will be almost immobile. Second: The front legs are quickly extended; the hind legs drawn in, the thorax with its increased moment of inertia hardly changes, while the rear of the body turns again clockwise; the half turn is completed.

Rules for Model Contest

(*Continued from page* 1018)

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable. Models made of matches should not be submitted to this department but should go to our Matchcraft Contest Editor.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight, prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the March contest must reach us on or before the 25th of December.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 53 Park Place, New York City.

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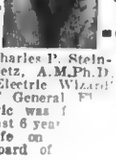

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H. L. Wood, a clerk, made more than $700 "on the side" before he had completed his course and also won $125 in prizes. Harry William Lord writes that he has more than doubled his salary as a result of studying this I. C. S. course in spare time. William Whitman, a former wagon builder, now has a sign painting business of his own and is earning *nearly three times* as much as he did before enrolling with the International Correspondence Schools.

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Wirekraft--$3,000.00 in Prizes

(*Continued from page* 1013)

it will be more popular than the Matchcraft Contest which expired last month. A decided advantage of this contest over the Matchcraft Contest is that models submitted will not break as easily. No names are listed on the Wirekraft page because no awards have as yet been announced. The list of names and the prizes which they win will be given in the April issue.

Rules of Wirekraft Contest

THIS is a wirekraft contest. Hence wire is to be used in the construction of all of the models entered in this contest.

The size of the wire to be employed is limited. The heaviest wire must not be larger than No. 8 American or B and S gauge, and the smallest no smaller than No. 30 B and S gauge—or (for foreign countries not having these exact sizes), the nearest available equivalent.

No. 8 B and S gauge is .12849 inches in diameter or 3.264 millimeters. Its nearest equivalent in the Birmingham or Stubs iron wire gauge is No. 18. In the Stubs steel wire gauge it is No. 30; in the British Imperial Standard it is No. 10. The nearest wire to No. 30 B and S gauge which is .01002 inches or .2546 millimeters in diameter is No. 31 in the Birmingham or Stubs iron wire gauge. In the Stubs steel wire gauge it is No. 80; in the British Standard it is No. 33.

The builder may avail himself of the opportunity of using any intermediate sizes of wires between No. 8 and No. 30, B and S gauge.

The wire may be copper, brass, iron, steel, or these materials coppered, tinned, nickel-plated, or galvanized, or the wire may consist of an alloy. Any kind of wire available on the market may be employed.

It is preferable to use non-rusting wires. The publishers will not be responsible for the rusting of any model. To protect wire which rusts easily or for color effects, the models may be painted, lacquered, varnished or otherwise covered.

Any additional decorations or accessories may be employed to enhance the effect. (Example: Silk on a lamp shade; glass in decorative fixtures; electric motors for operating mechanisms, etc.)

Only those portions actually constructed of wire will be judged.

(Example: A reed basket is suspended from a wire chain. The basket not being made of wire is NOT considered. On the merits of the chain only will the prize be awarded.)

Wires may be twisted, spliced, soldered, welded or bound together. Wire may be used to bind other wires together. If soldered a non-corrosive soldering flux should be employed.

There is no limit to the size of the models which may be entered nor to the number of entries which any maker may submit during any calendar month.

In every case the model must be forwarded express prepaid to SCIENCE AND INVENTION Magazine. It should be tagged with name and address of the maker, who will prepay charges if model is to be returned.

The first prize will always be awarded to a model possessing the greatest utilitarian merits. This must be an object NOT found on the market today.

The second prize will always be awarded to an object possessing the best decorative artistic or constructive effect. It may be a replica of an existing object or a model of an imaginative object or effect.

The remaining prizes will be judged from either one or the other viewpoints at the discretion of the judges.

All models may remain at the office of this publication until the close of the contest at the discretion of the editors.

This contest starts January 1st, 1927, and will terminate January 1st, 1928.

This is a monthly contest lasting for twelve months, each monthly contest closing on the first of the month following dates of issue. Thus the contest for the month of March, 1927, will close April 1st, 1927. Winners for March will be announced in the June Issue.

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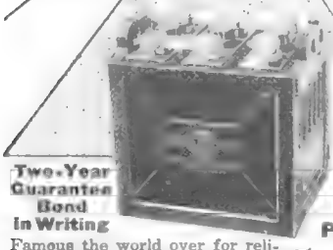

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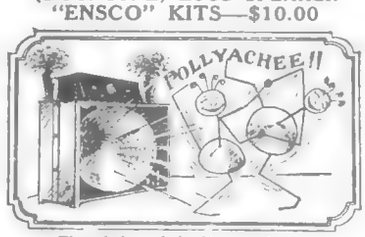

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Tools Required

THE tools required for the construction of Wirekraft articles may be found in the Dec. issue of this publication, a reprint of which will be sent free upon request. The following tools may be used advantageously:

1 pair flat-nosed pliers. 1 pair round-nosed pliers. 1 wire cutter. 1 hacksaw. 1 small vise. 1 soldering iron.

The materials which are necessary are:

Solder, soldering paste or flux, nails, one piece of wood, and most important of all, wire of the sizes specified in the contest rules and regulations.

If the builder decided to weld his wires together, a small welding transformer or a storage battery may be used for this purpose. For the formation of long cylinders, a coil winding machine or a lathe may be advantageously employed. Toy motors for the operation of any devices constructed of wire could of course be procured and added to the model and the addition of miniature sockets and bulbs to illuminate the interior of any buildings constructed of wire might also find a place in some of the constructions.

Hints on Home Heating

By H. WINFIELD SECOR

(*Continued from page* 994)

for suspending by wire hooks on the back of radiators, or else on the top of radiators, as the pictures below show. Sometime ago we described an electric humidifier in the columns of this journal, this device comprising an electric fan and wick arrangement for evaporating moisture, and circulating it about the room. Most warm air furnaces nowadays are fitted with water pans which have to be filled daily, or as is the case in several instances, the water or humidity pan is automatically filled by a float arrangement, similar to the tanks in bathrooms. One of the reasons why we catch cold so easily in the wintertime has been ascertained as due to the fact that we keep our homes and offices too hot and moreover too dry. Thus the reason for watching the humidity, and the wise home owner will buy himself a simple inexpensive hygrometer.

The third picture on page 994 shows a very useful idea in the form of an external coal bin made out of concrete. This saves cellar space, and the coal always feeds down to the shovel hole, as becomes apparent on inspection of the drawing. The concrete is mixed in the usual manner and moulded by means of wooden forms built of boards.

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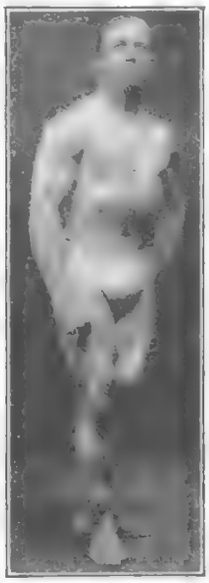

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Television by New French System

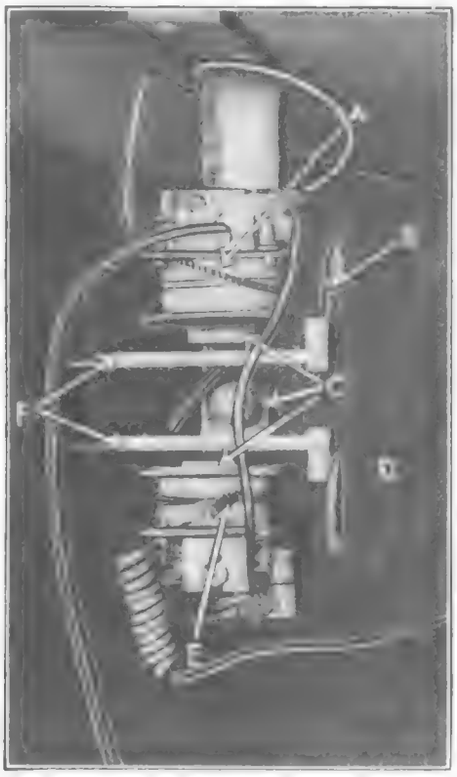
By LUCIEN FOURNIER

(*Continued from page* 988)

brilliance as to cause great discomfort to their possessors. Mr. Baird at the new demonstration showed that he could transmit faces of human beings sitting in a room of inky blackness to a screen fixed in another room in which the watchers were in total darkness.

The inventor accomplishes this seeming miracle by using invisible infra-red rays. Such rays, he states, will pierce fog. By means of them it will be possible for a general in future wars to see every movement, even in the darkness, enemy troops, and an airplane can be watched without the aviator realizing that his presence is detected. In a fog at sea a beam of invisible light sweeping the water in front of a vessel will pick up any object ahead of it, such as another vessel or land.

It is the inventor's belief that in another year television will be a commercial proposition and the apparatus will be sold for $150. It will enable its users to see and hear at the same time in connection with either the telephone or radio.



A—Coil producing alternating current of ten cycles; B—mirror; C—permanent magnetic circuit; D—frame; E—receiving coil of the tuning fork connected to the triode tubes; F—legs of the tuning fork (oscillating armature of the alternator).

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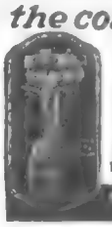

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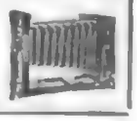

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The Power-Six Receiver

(*Continued from page* 1033)

balancing condenser. The proper setting is halfway between the settings where volume starts to increase. Replace filament connection to tube No. 2—and retune the station or signal carefully.

Remove either +A or —A filament connection to tube No. 1, and proceed to adjust balancing condenser No. 18 exactly as before, first finding approximate setting, then retuning carefully as before to find final setting. Rotate balancing condenser screw slowly, as the band of reduced volume is very small on this stage and may be missed. As soon as the position of reduced volume is found, retune carefully for loudest signal and rotate balancing condenser carefully to setting where signal becomes weakest or disappears. Replace filament connection to tube No. 1.

If the receiver has been carefully wired it may be possible to secure slight oscillation at wavelengths near 350 when volume control is full on. This is desirable for greatest sensitivity. If the receiver does not operate with sufficient sensitivity it indicates resistance at some part of the circuit, which may be due to some fault in construction or wiring. To increase sensitivity of receiver turn volume control to full on. Rotate balancing condenser No. 20 by half turn stages tuning in signal near 350 meters after each half turn adjustment until receiver beats or whistles are heard when rotating dials carefully across signal. Then turn balancing condenser back carefully enough to just stop such beats or whistles.

For distant reception best results are often possible when the receiver is adjusted so as to cause slight oscillation beats or whistles with volume control full on, especially near 350 meters. However if receiver is adjusted to such sensitive condition always keep volume control below the point of distortion or beats.

SHIELDING

We do not recommend shielding this receiver. Shielding, unless designed in the laboratory by competent engineers is very likely to reduce the efficiency of the receiver.

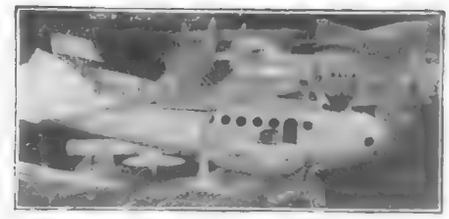
TUNING

With the tuning controls used here the approximate position for each wavelength is indicated directly. In tuning rotate the two dials together, keeping them both at approximately the same reading as the setting may not be exactly the same for each dial.

The capacity between circuits will vary in different sets due to variations in individual wiring, as well as any slight differences between individual coils and condensers, no matter how closely matched. Therefore with each condenser unit there is a small variable "trimmer" condenser. When once adjusted, the rear trimmers are not changed and the front trimmers only for very fine work in tuning. The trimmers are used to bring the circuits into resonance. The setting of front trimmer, and to a certain extent the dial reading, is affected by the position of the rear trimmer.

To begin adjustment set the rear trimmer on the left hand condenser full out. Set the rear trimmer on the right hand condenser full in. Then rotate panel trimmer back and forth rapidly as the main dial is moved slowly a few degrees to each side of the approximate setting for the station desired. Set dial at point where greatest volume results, then adjust trimmer for greatest volume. Next do this same thing with the other dial and trimmer.

Try to get the point of greatest volume with the front trimmer near its central position, and for fine tuning you may then turn



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either way without going beyond the range of the front trimmer. If this point of maximum volume does not come with the front trimmer near the central position, change the rear trimmer slightly and try again. You will find this easier than it sounds.

KEEPING CIRCUITS IN TUNE

When searching for weak, distant stations, it is necessary that all tuned circuits be kept in resonance—otherwise the station may not be heard; that is, it may be passed by. To keep the circuits resonant, in other words, tuned to the same wavelength when the tuning controls are rotated, is difficult unless you are systematic.

A simple rule is simply to follow the outside sounds or noise. There is always a certain amount of static present. If your tuning controls are kept together these sounds can be heard as you turn the dials, although there may be no station signal. Keep your circuit resonant so that these static noises can be heard, as you go up or down the scale and you will locate practically all stations within range. By recording dial readings these stations may be located thereafter without difficulty.

USE OF TUNING CONTROLS

Selectors one and two are used to tune the receiver to the same frequency as the signal to be received. For strong signals close tuning is not necessary and it may even be desirable to rotate selector to slightly out of resonance to prevent over-loading. However, weak signals require very close adjustment of selectors for maximum volume and volume may be considerably increased by means of the "trimmer" knobs. Always operate at lowest volume consistent with size of room.

Volume or sensitivity may be increased by rotating the volume control. Increasing the sensitivity beyond a certain degree may cause the circuit to go into oscillation. This is indicated by a "click," oscillation beats, whistles or distorted signals. Always reduce sensitivity below this point.

When tuning weak signals use both hands, tuning each control and its trimmer carefully. Then adjust sensitivity control carefully for loudest clear signal. See "Tuning."

TUBES

This circuit is designed for the use of 201-A or 301-A tubes or their equivalent in the three radio frequency stages and first audio. We recommend the 200-A or similar tube as a detector, and the UX-112 or its equivalent in the last stage of audio frequency amplification.

DRY CELL TUBES

Type 199 may be used, but the volume will be less than with standard 201-A tubes.

ANTENNA

Use either an indoor or outdoor antenna, composed of a single straight wire 20 to 60 feet in length. Loop antenna is not recommended. Use water pipe as ground if possible.

RHEOSTAT

Operate tubes at lowest brilliancy consistent with satisfactory results. If dry cell tubes, type 199 are used, a 10-ohm rheostat must be used instead of a 3-ohm unit specified for standard tubes.

CONCLUSION

This circuit and parts therefor have been worked out with utmost care to fulfill the particular functions for which they were designed. You cannot change any one part of a circuit without affecting some other part. Therefore, follow instructions, unless you are more interested in experimenting than in results.

TOOLS REQUIRED IN BUILDING THE POWER SIX RECEIVER

Pliers, several kinds; screw drivers, several sizes; hammer; hacksaw and blades; hand drill; twist drills, several sizes; scriber; center-punch; soldering iron, electric or other type; wire solder, self-fluxing or plain solder and non-corrosive flux; rule, steel or wood; small tool and awl handle very useful; volt and ammeters for testing set, batteries, etc.

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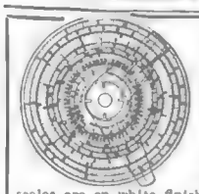

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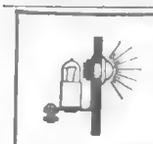

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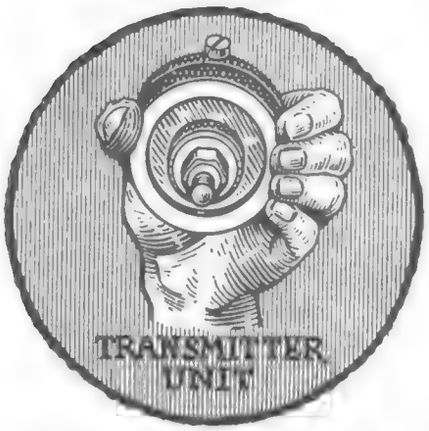

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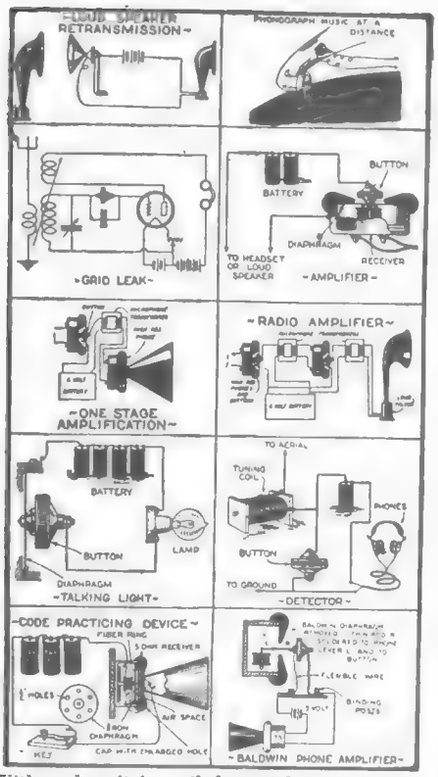

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Rules for Matchcraft Contest

(*Continued from page* 1007)

$100.00 Monthly Prize "Matchcraft" Contest

DURING the past year SCIENCE AND INVENTION Magazine awarded $5000.00 for articles made entirely of matches. While this $5000.00 contest has officially expired, the publishers have decided that because of the great popularity in Matchcraft constructions, the contest would continue in force on a new prize rate basis until further notice. The list of new prizes will be found in the center box and the same rules for the first contest are to be observed in this contest.

(1) Models submitted must contain at least 90 per cent. safety matches in their construction.

(2) Models made of toothpicks, paper matches, or non-safety matches, are not eligible in this contest.

(3) Models can not be built around boxes or other supporting articles. Walls, roofs, etc., must all be self-supporting and made of matches.

(4) All liquid adhesives, such as glue, shellac, cements, etc., are permissible.

(5) Models may be painted, gilded or silvered.

(6) Models may be of any size.

(7) In order to win a prize, it is necessary that either models be submitted, or, if this is not practical, owing to their size, a 5"x7" photograph of the model may be sent in lieu of the model itself. The best models submitted each month will be awarded the prizes scheduled herewith.

(8) All models submitted to SCIENCE AND INVENTION Magazine will be promptly returned to the builder, who will prepay all charges.

PRIZE AWARDS

First Prize	$50.00
Second Prize	20.00
Third Prize	15.00
Fourth Prize	10.00
Fifth Prize	5.00
Total	$100.00

(9) Where SCIENCE AND INVENTION has any doubts as to the model (where photos only are submitted) complying with all the regulations, the judges may, at their discretion, request that the actual model be sent in for inspection, paying transportation charges both ways.

(10) This is a monthly contest and will continue until further notice. Each monthly contest closes on the first of the month following date of issue. Thus the contest for the month of March will close April 1st and prize-winning announcements will be made in the June, 1927 issue.

(11) Models must be shipped in a strong wooden box, never in a cardboard box, as SCIENCE AND INVENTION can not be held responsible for breakage in transit due to models having been improperly packed.

(12) When models are sent, be sure to affix tag, giving your name and address, to the model itself. In addition, put name and address on outside wrapper of package.

(13) Address all letters, packages, etc., to Editor, "Matchcraft" Contest, care SCIENCE AND INVENTION Magazine, 53 Park Place, New York.

Caution—Soak or cut heads from matches before building your model so that the models may be expressed or mailed. The strike-everywhere square cut Liberty matches can be used if the heads are cut off.

LIGHTS ON THREE AIRWAYS

Light on the transcontinental airways between Chicago and St. Louis, and Chicago and Dallas were turned on recently.

One-half of the lights on Route 2 of the airways, from Chicago to St. Louis, and Route 3, Chicago to Dallas were switched on at Christmas time.

The lights on Route 1, from Boston to New York were to be turned on Feb. 1.

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Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the May issue must reach us not later than March 10th.

The Circulation of Science and Invention is over 200,000 and climbing every month

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$60—$200 a week. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 441 B., North Clark, Chicago.

$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

Bankrupt and Rummage Sales. Make $50.00 daily. We start you, furnishing everything. Distributors, Dept. 171, 609 Division, Chicago.

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Agents are cleaning up with National Fibre House Brooms and Auto Mitten Dusters. Send for Free Catalog and Sample Offer. National Fibre Broom Co., St. Louis, Mo.

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Our New Household Device washes and dries windows, sweeps, cleans walls, scrubs, mops. Complete outfit costs less than brooms. Over half profit. Harper Brush Works, 152-3rd St., Fairfield, Iowa.

Agents Wanted (Continued)

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Your Chemical problems solved and working process furnished for Five Dollars. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

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Detectives Earn Big Money. Travel. Excellent opportunity. Great demand everywhere. Experience unnecessary. Write, American Detective System, 1974 Broadway, N. Y.

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Plays, musical comedies and revues, minstrel music, blackface skits, vaudeville acts, monologs, dialogs, recitations, entertainments, musical readings, stage handbooks, makeup goods. Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 99, Chicago.

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We Finance Your Application and assist selling the patent. Patent Bureau, Times Bldg., St. Louis, Mo.

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Print your own cards, stationery, circulars, paper, etc. Complete outfits $8.85; Job Presses $11, $29; Rotary $119. Print for others, big profit. All easy, rules sent. Write for catalog presses, type, paper, etc. Kelsey Company, F-6 Meriden, Conn.

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Boys! Don't overlook this. The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalogue. Detector with Galena Crystal complete 50c, the same detector with Radiocite Crystal 75c prepaid. Send for yours today. Radio Specialty Company, 100 Park Place, New York City.

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Storage battery soldering iron heat in ten seconds. Guaranteed, price $3.00. Orlando Elec. Specialty Co., Box 599, Orlando, Fla. Agents Wanted.

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We Have a Clean Dignified Offering that is a sure-fire money maker. Men on our sales force are welcome wherever they go, and their earnings are substantial. You can qualify if you're honorable, straight-forward, reliable. We have a high-class offering and so want only high-class men. If you're such a man, write us. Address Salesmanager, 870 West Adams, Dept. 78, Chicago.

Salesmen Wanted. Nationally advertised, universally needed product. Sells to Stores, Garages, Factories, Schools, Homes, Farmers, Auto Owners. Used by everybody. Big demand, ready sale. Big commissions. Complete sales training given. Credit extended to customers. Sample can be easily carried. Concern rated very high—established many years. Opportunities for lifetime jobs at big pay. Address Territory Manager, Dept. 60, Post Office Box 983, Dayton, Ohio.

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Song-poem writers. Address Monarch, 1472 Broadway, Dept. 1335, New York.

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BOOK REVIEW

THEN

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No matter how much or how little you know of your radio receiver, this new "Radio Trouble Finder" book is going to be a big help.

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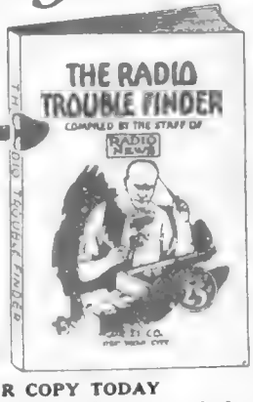

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THE CUSTOMS OF MANKIND by Lillian Eichler. Stiff cloth covers 5¾" x 8¾", illustrated, 754 pages. Published by Nelson Doubleday, Inc., Garden City, N. Y. Price $3.00.

The lady who wrote this work states on her title page that it has notes on modern etiquette. The frontispiece, however, gives a view which it is to be hoped refers to ancient etiquette. It really seems curious that the customs of mankind should be formed and developed into such fixity as to give material for a seven hundred-page book like the present. The subject ranges from the sources of origin of etiquette all through the development of civilization, and there is an attempt to get at the origin of all the ways of even modern society, such as the hand-shake, the raising of the hat, kissing, courtship, marriage customs, the history of writing, the holidays, burials, are all treated; and an interesting, although rather short, section treats on the subject of children and the relation to their parents. Among aboriginal customs pressing noses and rubbing noses are included. Even the barber pole is spoken of with its origin attributed to the original use of it to be held by the patient whom a barber was bleeding, and to the same unfortunate barber was attributed the origin of tipping and it is referred etymologically to the initials of the three words, "To Insure Promptness." All sorts of curious things appear in the section on popular superstitions. Bicycling, golf and basketball are among the games spoken of. At the end is given a four-page list of authorities consulted, and a two-column index of twenty pages closes the work, which we warmly commend to our readers.

THE HUMANIZING OF KNOWLEDGE, by James Harvey Robinson. Stiff cloth covers, 4¼ inches by 7 inches, 94 pages. Published by George H. Doran Co., New York City. Price $1.00.

Claim is made that the author's educational theories have caused wide discussion and have brought universal commendation. The book is pleasant reading even though one may doubt whether the commendation will be quite universal. He appreciates the work done by the wonderful Grecian philosophers and he brings out the idea that the doctrines of Aristotle, whom he terms the greatest of all scholars and scientists, actually operated to better human knowledge. Glancing through the book gives the impression that the author takes a very sensible view of the great educational question which has been foolishly forced upon the nation of whether evolution shall be taught in the schools.

PROSPERITY THROUGH POWER DEVELOPMENT. Stiff cloth covers 6" x 8¾", 60 pages. Published by National Electric Light Association, New York City.

This is a convenient summary or compilation of papers presented at the first World Power Conference of 1924 held at London. It treats of government regulation, of super-power stations, of public versus private ownership and related topics, and makes a very convenient little treatise.

FUNDAMENTAL PRINCIPLES OF GENERATORS AND MOTORS; EXAMPLES by Prof. F. E. Austin, E. E. Stiff cloth covers, 5" x 8", illustrated, 108 pages. Published by Prof. F. E. Austin, Hanover, N. H. Price $2.50.

This author-published book is practically the tenth of a series which Prof. Austin states are to be found at all public libraries and can be procured from any book dealer. It is a mass of calculations and does not lend itself to easy review, yet, on glancing through it, the diagrams themselves suggest what may be termed a picturesque treatment of the subject, and the numerous calculations and formulas operate to bring us right down to earth. Wire-tables and an index close the work. It is unpleasant to criticize, but we would like the wire tables to have included the carrying capacity of wires either on the Underwriters' or other standard basis. The author is rather ultra-logical in giving the practical units, the volt, ampere, etc., and omitting for the moment the ohm, which, however, occurs three pages later, but so far the reviewer has not yet found the ohm defined by the author. But this, of course, is rather captious for the work is to be commended to the electric engineer.

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DAS NEUE UNVERFUM. Stiff cloth covers, 6¼" x 9½", illustrated, 473 pages. Published by Union Deutsche Verlagsgesellschaft, Berlin, Germany.

This is a scientific annual and the copy before us marks its forty-sixth year. The Navy of the United States now possesses one of the largest, if not the largest, floating crane in the world which has been mounted on an old battleship. The frontispiece in this book shows a land crane in the Hamburg harbor lifting up a first-class passenger car—a close competitor with our floating crane. The name of this book suggests difficulty in reviewing it. It starts with a section devoted to fishing, hunting and adventure. Then come stories of countries and strange people, all of which, with numerous illustrations, is of decidedly general interest. One story, as we may call it, depicts the greatest thirst on the waterless desert with a very impressive colored picture of a rider alone in the wilderness. All sorts of other subjects follow, there being the greatest variety of topics, and it interests us very much to see that the pages of "The Experimenter" and other associate publications have been utilized to add to its interest. Thus we find a future city reproduced from its columns, all the captions being translated into German. We mention this because it is an indication of thoroughness on the part of the publishers, which thoroughness appears all through the book. There is comparatively little attempt to classify the subjects, and it may almost be said that this very feature, which might be interpreted as a defect, makes the book more interesting. Of course the idea is for it to be popular reading and such it certainly is. America contributes her share. We even find the progress of the great carving on the face of the great cliff on Stone Mountain, Ga., very thoroughly illustrated. Two pictures are given of the ship on which the Flettner Rotor was tried before and after the installation. They are given on opposite pages and the contrast is certainly curious. Airplanes, gliders and dirigibles give matter to fill a number of pages. Many animal pictures are given mostly in black and white, and a limited number of colored pictures add greatly to the artistic value of the book. A special section is devoted to radio, and to this we find that THE EXPERIMENTER and RADIO NEWS have contributed, and an article by the writer of this review on the subject of chemical manipulation has been utilized. We are gratified to find our work appreciated in the Fatherland. To those who can read German, we warmly recommend the book.

RADIOTECHNIK, by Prof. J. Herrmann. Stiff cloth covers, 4" x 6¼", illustrated, 128 pages. Published by Walter de Gruyter & Co., Berlin, Germany .

This is indicated as the first of a series of books on the titular subject of radio science, the present one appearing as a general introduction. In its rather short scope of about 130 pages, it gives a nice little presentation of the subjects, and its scope is certainly very extended in proportion to the size of the book.

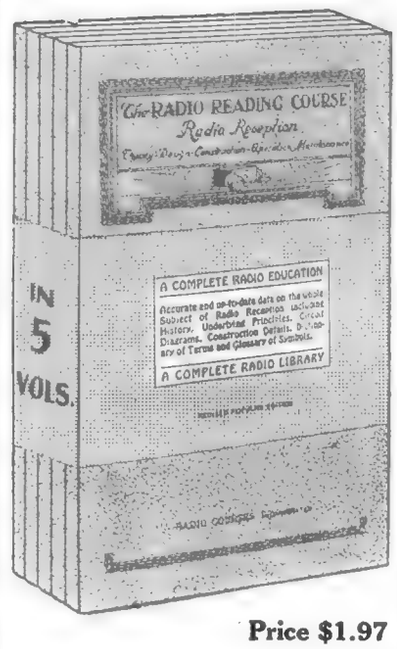
GENERAL SCIENCE by William H. Snyder, Sc.D. Stiff cloth covers 5" x 7½", profusely illustrated, 591 pages. Published by Allyn & Bacon, New York City. Price $1.60.

The title of this book, "General Science," includes within its scope an appalling range of information. It has been selected by the author of the work, Dr. Snyder, to make a most interesting manual for general reading, touching on almost every branch of natural science with a quantity of illustrations, one or more to a page. It is a little distracting to run through its pages, for the text of chapter following chapter jumps about all over the field of knowledge, and sometimes the jumps are pretty long. The effect of this is that it will never lose interest to the reader, and it will be found unexpectedly up to date, because we generally expect such a work to be more or less behind time, and this certainly is not.

PHASES OF MODERN SCIENCE. Stiff cloth covers 5½" x 8¾", 232 pages. Published by A. & F. Denny, Ltd., 163A Strand, London, W.C. 2, England.

This very peculiar book, in the good sense of peculiarity, approaches a catalogue as it is published in connection with the science exhibit at the British Empire Exhibition. The best authors and highest scientists of England have contributed the articles, so that they are in the very fullest degree authoritative. "The Origin of Wireless," by Sir Richard Glazebrook, and "Thermionic Valves," by Prof. Fleming, are typical of the subjects treated. We are glad to see acknowledgement made of the work of Thomas A. Edison, as the Edison effect discovered by the great American inventor is at the base of all modern radio. These two chapters follow each other, but all sorts of chemical and physical biological topics are given in a series of monographs, which are only too short, and whose list of authors presents a wonderful array. Sir Ernest Rutherford, Sir Joseph Thompson, Sir Oliver Lodge, Dr. F. W. Aston may be cited as among the authors. Dr. Aston's article on atoms and isotopes was made up in part of abstracts from lectures delivered before the Franklin Institute of Philadelphia.

(*Continued on page* 1077)



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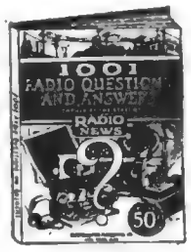

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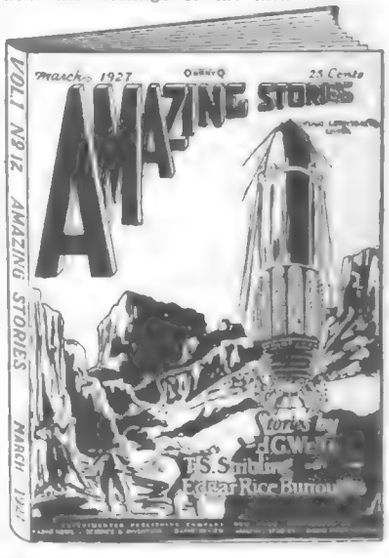

Some of the big feature stories of the March issue just out are:

The Green Splotches by T. S. Stribling.

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SCIENTIFIC RESEARCH AND HUMAN WELFARE. By Franklin S. Harris, Ph.D. Stiff cloth covers 5¼" x 8", 406 pages. Published by The Macmillan Co., New York City. Price $2.50.

This book comes from the Capital of Mormandon, Dr. Harris, its author, being President of Brigham Young University. The introduction, which lets us know to some extent the views of the author, puts us at once on our feet in preparation for going through the book. The topics are very numerous, there being no less than fifty chapters in its 373 pages. It gives a very fine resumé of what is being done in the world, and what has been done to ameliorate the lot of mankind. As an example of the detail of the book, there is a chapter on saving steps for the housewife. Here we find the electric iron described as using up about forty million dollars' worth of electricity every year. It is not enough for him to cite the sewing machine, but he cites the electrically drvien one, and so from one end of the book to the other every sort of detail is brought in to tell the story of modern times from the standpoint of food, medicine, dyes, etc. We believe it will be rather hard to think of any topic in modern improvement which will not be found directly or indirectly spoken of here.

THE SPECTROSCOPY OF X-RAYS by Manne Siegbahn, Professor in the University of Upsala. Translated by George A. Lindsay, Asst. Prof. of Physics in the University of Michigan. Stiff cloth covers 6¼" x 9½", illustrated, 288 pages. Published by Oxford University Press, New York City. Price $6.00.

From the great Swedish University of Upsala, this most valuable treatise comes. It opens up with a summary on the knowledge of X-rays prior to the year 1912. At this time Laue had a happy idea, as our author calls it, of using the crystal edifice as a grating for X-rays, just as the spectroscopists use a Rowland grating, as we may term it, for light-spectroscopy. The book goes on to give very full details of X-ray apparatus with many diagrams and illustrations, and goes into all the details of how the investigations are carried out, treats at length on the arrangement and theory of the spectra, and then comes to the *crux* of the subject in the shape of the continuous X-ray spectrum, its total intensity and intensity of distribution. All this applies to the atom. In the measurement of the length of the extremely short X-ray waves, Millikan's work is most appreciatively used. The appendix is an excellent example of what such a section should be, giving a great number of most interesting tables and a bibliography; the latter filling twenty pages gives an idea of the immensity of this subject.

CRYSTALS AND THE FINE-STRUCTURE OF MATTER by Frederich Rinne, Professor of Mineralogy in the University of Leipsic. Translated by Walter S. Stiles. Stiff cloth covers 5½" x 8¾", illustrated, 196 pages. Published by E. P. Dutton & Co., New York City. Price $4.20.

We have just reviewed a book on this subject coming from Upsala, Sweden. Here Leipsic University in Germany gives us another treatise on the structure of crystals and atoms. As a mere matter of book making, we have the same to say about it as we did about the other one, that it is worthy of all commendation. It has for its subject very liberal illustrations, and the isometric production used throughout in conjunction with half-tones give a most attractive aspect to its pages. The table of atoms gives the ninety-two numbers, which table as we now know is pretty nearly filled. So many attractive books are appearing on this and analogous subjects that one feels that all science is not open to any one person and that the limitations of time require the individual to restrict his devotion to sub-divisions only, for such limited division may require a lifetime for its study. The Laue effect to which we alluded to in our review of Prof. Siegbahn's book is here very nicely treated with illustrations. An interesting feature of the book are portraits of leading scientists. The portrait of the famous Abbé Hauy, who over a hundred years ago founded modern crystallography, is most impressive. A very fine portrait of Dr. Röntgen heads the book, and a reproduction of an Albert Durer engraving representing melancholy is given.

VON DER FASER ZUM GEWAND, by Dr. Hans Wolfgang Behm. Stiff cloth covers, 5¼" x 7¾", illustrated, 76 pages. Published by Kosmos, Stuttgart, Germany.

Ladies like silk and other textiles when they take the shape of dresses. In many homes today handweaving is being done which is certainly quite a fascinating occupation. The seventy pages of text in this little book is a very interesting presentation of spinning and weaving arts, which presentation is so good that we certainly recommend it to those of our readers who can read German.

(*Continued on page* 1079)

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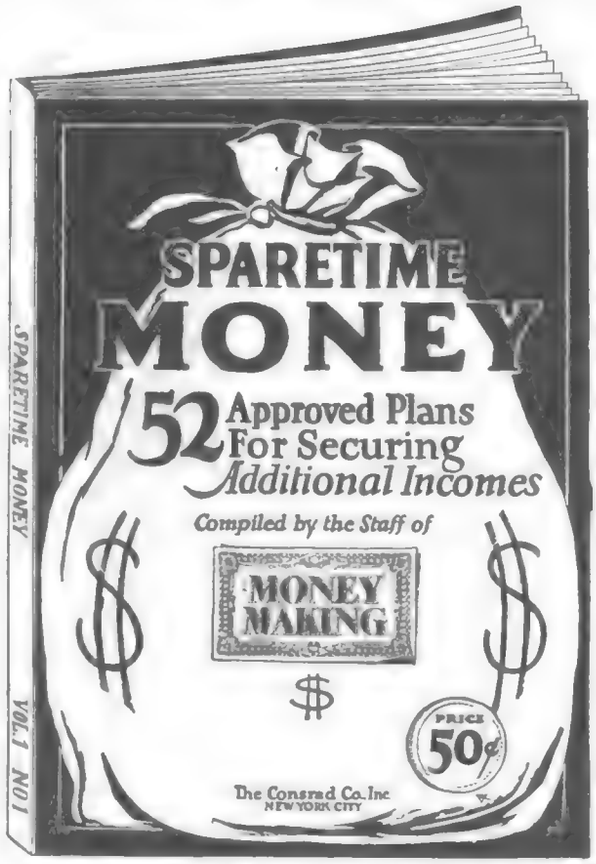

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VOM VORIGEN ZUM NACHSTEN KRIEG, by General Major Freiherr Von Schoenaich. Stiff cloth covers, 5" x 7½", 181 pages. Published by Neuen Gesellschaft, Berlin, Germany.

This book contains so much of international politics and naturally from the German standpoint, that we cannot within the limits of our space give an adequate treatment to it. It starts with what evidently is an indignant presentation of the topic by bringing to the front the statement that the English, or rather that some of the English, contemplated the organized destruction of all German factories as a good way to get rid of German competition. They do not seem to relish the idea of the destruction of Germany, and the author cannot be blamed for this, but we find very little in it about the destruction of Belgium and the ruining of France, which fortunately was very incomplete after the miracle of the Marne. It notes that a student attacked Albert Einstein in Germany with gas bombs because he was a Jew and a Pacifist. Another celebrated law professor, Walter Schuecking, had to leave Marburg because the students didn't like his Pacifist attitude. Other incidents are given with laughable and also sad features of militarism among the people. It seems that one of the German generals is quoted as saying that he is the only man who can make a revolution ("Putsch") in Germany, and that he said he wouldn't, while others claim he said, "I will not do it yet." The book makes one feel as if Germany was on anything but a secure foundation.

SURVEYING FOR EVERYONE, by A. Francon Williams, F. R. S. G. S. Stiff cloth covers, 4¾ inches by 7½ inches. Profusely illustrated, 114 pages. Published by Macmillan Co., New York City. Price, $1.40.

This is an unusually attractive little book and covers its titular subject quite satisfactorily, and as an example of its treatment we would refer to the method of finding the area of an irregular field as shown on page 31. Plane table work is given which always impresses one very favorably and the wonderfully attractive prismatic compass is described and surveying by it is also described.

PLANTS AS INVENTORS, by R. H. France. Paper bound stiff covers, 5 inches by 7¾ inches. Profusely illustrated, 64 pages. Published by Albert and Charles Boni, New York City. Price, 40c.

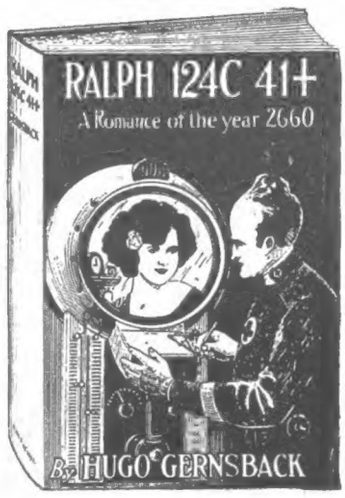
The title of this book is undoubtedly designed to catch the eye and to attract readers. The idea seems so odd, but we do get a little comfort from emphasized statements on pages 48 and 49, one of which starts out with the assertion that it is not the plant which invents. This assertion is really a comfort because how in the world a plant is going to invent anything when many of the inventions of humanity are so futile and useless, is certainly rather a puzzle. Turning to the text and illustrations we find the book really suggests that we find things in plant life which are similar to human inventions and even suggestive of them. There are numerous illustrations.

MACHINE SHOP HANDBOOK, by the International Correspondence Schools, 335 pages, 282 illustrations, size 3¾" x 5½", published by the International Text-book Company, Scranton, Pa. Price cloth bound $1.00. Leatheroid bound. Price $1.50.

This interesting little volume is crammed with knowledge which will help in solving many difficult problems. The publishers have endeavored in this book to compile such information as will be of value to persons engaged in shop work. For the greater convenience of the user it has been made a reference book of small size but containing a vast amount of information needed by the mechanic. A special system of indexing is employed. Every important item is indexed under all letters in which it is likely to be sought, thus making it easy to find information on any subject. The following subjects are treated: useful tables and rules; shop work; and first aid to the injured.

AUTOMOBILE HANDBOOK, by International Correspondence Schools, 345 pages, 156 illustrations, size 3¾" x 5½", published by the International Text-book Company, Scranton, Pa. Price cloth bound $1.00. Leatheroid bound. Price $1.50.

The rapid growth of the automobile industry and consequent demand for information has induced the publication of this book. This handy manual contains such data as are most useful to the chauffeur, repairman, owner and salesman. It also contains practical information on automobile troubles and remedies in such form as to be readily available. The illustrations have been taken from the latest models of cars so that the handbook is strictly up to date. The illustrations will be found especially useful to the driver or owner who wishes to obtain a comprehensive knowledge of the construction and operation of auto engines, transmission, carbureters, etc. Such tables as are desirable have been inserted, together with excerpts from the auto laws of all the states.



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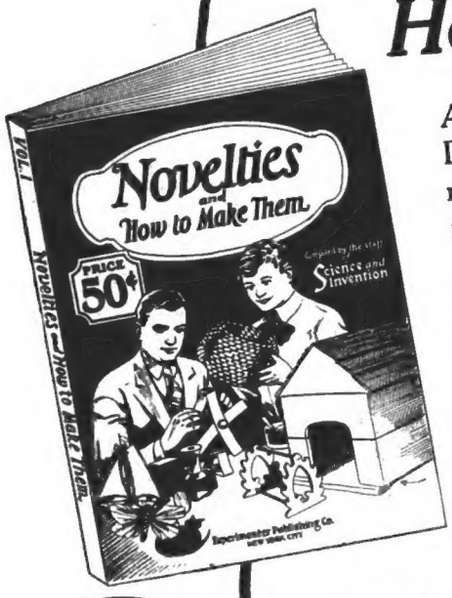

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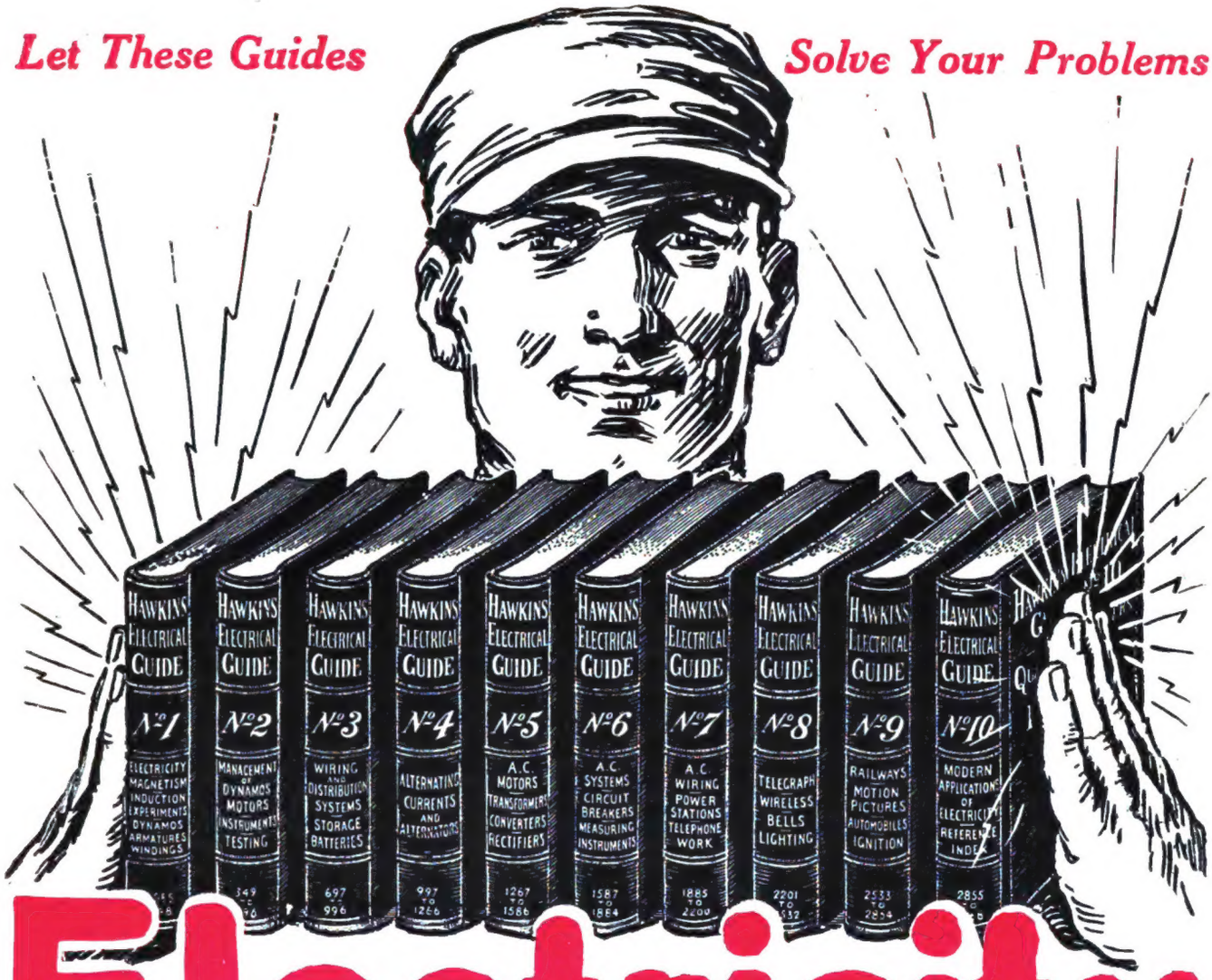

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